IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

APPELLANTS:	Birkhoelzer et al.	CONFIRMATION NO. 7671
SERIAL NO.:	09/992,974	GROUP ART UNIT: 2152
FILED:	November 19, 2001	EXAMINER: Ramsey Rafai
TITLE:	"MEDICAL SYSTEM ARCHITECTURE WITH A WORKSTATION AND A CALL SYSTEM"	

MAIL STOP APPEAL BRIEF-PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPELLANT'S APPEAL BRIEF

S I R:

Pursuant to 37 C.F.R. §41.37, Appellants herewith submit their main brief in support of the appeal of the above-referenced application.

REAL PARTY IN INTEREST:

The real party in interest is the assignee of the present application, Siemens Aktiengesellschaft, a German corporation.

RELATED APPEALS AND INTERFERENCES:

There are no related appeals and no related interferences.

STATUS OF CLAIMS:

Claims 1-22 are the subject of the present appeal, and constitute all pending claims of the application. No claims were added or cancelled during prosecution before the Examiner.

STATUS OF AMENDMENTS:

The present appeal is being taken from the Office Action dated January 31, 2007, which was not a Final Rejection, but which was the second time the claims on appeal have been rejected. In that Office Action, claim 1 was objected to because

the Examiner stated the term "said examination images" in line 5 lacked sufficient antecedent basis. Amendment "D" was filed simultaneously with the present Notice of Appeal and Appeal Brief, wherein claim 1 was amended to overcome this objection. This objection was also the subject of an interview conducted with the Examiner, wherein it was agreed that amending claim 1 in this manner would overcome this objection. Accordingly, Appellants assume that this objection will be overcome, and need not be addressed herein. Since Amendment "D" was filed simultaneously with the present Appeal Brief, the status of Amendment "D" is not known at this time, but Appellants see no reason why Amendment "D" should not be entered.

SUMMARY OF CLAIMED SUBJECT MATTER:

The claims on appeal concern a medical system architecture of the type initially described wherein call system linked into the medical workflow for the transmission of messages, for example as datafiles, is allocated to at least one of the workstations. The user of a medical workstation, for example a modality, can send digital messages to an expert in an electronic manner proceeding from the console of the workstation. The medical modalities can be, for example, an MR, CT, ultrasound, X-ray or angiography device, a nuclear camera, supervision monitor, diagnostic workstation or irradiation apparatus. An automated expert call system to a mobile communication device proceeding from a workstation is thus obtained that is integrated into the work and data context of the medical workstation. Due to the combination of the workstation with a call system, a completely new application scenario arises wherein the radiologist — as an expert — is available by retrieval.

This application scenario has not been realizable with the previous means (for example, image transfer to workstations). (p.2, l.22 -p.3, l.11)

Claim 1 (the only independent claim of the application) is set forth below, with exemplary citations to the specification and drawings for the claim elements.

1. A medical system architecture comprising:

an imaging modality for acquiring medical examination images of an examination subject (any of CT unit 1, MR unit 2, DSA unit 3, x-ray unit 4, Fig. 1, p.5, l.3-8);

a workstation selected from the group of workstations consisting of workstations for acquiring said examination images (any of workstations 5-8; Fig. 1, p.5, l.8-11), workstations for sending said examination image (also any of workstations 5-8) p. 5, l.12-17), and workstations for receiving said examination images (viewing workstations 11; Fig. 1, p.5, l.18-24);

a system connected to said workstation for transmitting said medical examination images to at least one location remote from said workstation (communication network 9; Fig. 1, p.5, l.12-14); and

a call system allocated to said workstation for transmitting messages together with data representing said medical examination images to a remote location (Fig. 2, p.6, l.17-23 and Fig. 3, p.7, l.3 -10).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL:

The following issues are presented in the present Appeal:

Whether the subject matter of claims 1-14 is anticipated under 35 U.S.C. §102(e) by United States Patent No. 6,321,113 (Parker et al.);

Whether the subject matter of claim 15 would have been obvious to a person of ordinary skill in the field of medical system architecture design under the provisions of 35 U.S.C. §103(a) based on the teachings of Parker et al. in view of United States Patent No. 6,629,131 (Choi);

Whether the subject matter of claims 16-19 and 22 would have been obvious to a person of ordinary skill in the field of medical system architecture design under the provisions of 35 U.S.C. §103(a) based on the teachings of Parker et al., further in view of "Official Notice" of various types of communication software and components;

Whether the subject matter of claim 20 would have been obvious to a person of ordinary skill in the field of medical system architecture design under the provisions of 35 U.S.C. §103(a) based on the teachings of Parker et al., further in view of United States Patent No. 6,304,898 (Shiigi); and

Whether the subject matter of claim 21 would have been obvious to a person of ordinary skill in the field of medical system architecture design under the provisions of 35 U.S.C. §103(a) based on the teachings of Parker et al., further in view of United States Patent No. 6,829,478 (Layton et al.).

ARGUMENT:

Rejection of Claims 1-14 Under 35 U.S.C. §102(e) as being Anticipated by Parker et al.

Claim 1 claims a medical system architecture wherein examination images of an examination subject are acquired with an imaging modality, and are supplied to a workstation that is connected to a system for transmitting the examination images to at least one location that is remote from the workstation. The medical system architecture of claim 1 also requires a call system allocated to the workstation for

transmitting messages *together with data representing the medical images* to a remote location.

Appellant's position with regard to all rejections based on the Parker et al. reference (Exhibit D) is that there is no disclosure in the Parker et al. reference describing the generation or transmission of images in general, nor any disclosure of the transmission of medical images or examination images (both terms being used in claim 1, as noted above). The Parker et al. reference is exclusively concerned with the generation and transmission of text data, possibly combined with a representation of an electrical signal, such as an ECG. Appellants argued that an ECG is simply a trace or a curve, representing a single electrical signal, and does not represent a medical examination image, as that term is commonly understood by those of ordinary skill in the field of medical imaging.

Numerous standard texts and dictionaries support the position of the Appellants that the term "medical examination image" is not considered by those of ordinary skill in the field of medical imaging to encompass an ECG.

Attached hereto as Exhibit "A" is an excerpt from the *McGraw-Hill Dictionary of Scientific and Technical Terms*, providing a definition of medical imaging as the production of visual representations of body parts, tissues or organs. This definition clearly does not encompass an ECG, and electrocardiography is not listed as being among the general categories of medical imaging provided in that definition.

Exhibit "B" is an excerpt from a standard medical text (*Foundations of Medical Imaging*), and in the introduction, that provides an overview of all types of medical imaging that will treated in the text, a definition is provided in the third full paragraph at page 4, stating that modern or contemporary medical imaging is a two-part

process: (1) the collection of data concerning the interaction of some form of radiation with tissue, and (2) the transformation of these data into an image (or a set of images) using specific mathematical methods and computational tools. Clearly an ECG is simply a measurement of an electrical signal, and does not involve the interaction of radiation with a subject. In this regard, it is no different than a curve representing a measurement of blood pressure, temperature, etc., and thus falls into the category of "sensing" rather than "imaging." An excerpt from another standard text (*Principles of Medical Imaging*") Is attached hereto as "Exhibit "C". In the Preface to that textbook, the various categories of medical imaging (imaging modalities) are listed, and clearly ECG is not included.

Appellants respectfully submit that the exhibits hereto are highly representative of the meaning that those of ordinary skill in the field of medical imaging ascribe to the term "medical examination images," and they clearly demonstrate that those of ordinary skill do not ordinarily consider an ECG to fall within that definition.

In the context of the anticipation rejection based on Parker et al., this is not simply a trivial or semantic distinction. The fact that the Parker et al. reference does not provide any *disclosure* whatsoever with regard to acquiring or transmitting medical examination images, as that term is commonly understood by those of ordinary skill in the field of medical imaging, is sufficient to overcome the anticipation rejection of claims 1-14 based on the Parker et al. reference, since the Parker et al. reference does not disclose all of the elements of claim 1 as arranged and operating in that claim. Claims 2-14 add further structure to the novel combination of claim 1, and therefore are not anticipated by Parker et al. for the same reasons.

Rejection of Claim 15 Under 35 U.S.C. §103(a) Based on Parker et al. and Choi.

As to all of the rejections under 35 U.S.C. §103(a) wherein Parker et al. is relied upon as the primary reference, in combination with respective secondary references or "official notice," the distinction between a "medical examination image" and an ECG is relevant because, in order to substantiate a rejection under 35 U.S.C. §103(a) based on a modification of the Parker et al. reference, the Examiner must provide evidentiary support for the position that it would have been obvious to a person of ordinary skill in the field of medical imaging to make use of the teachings of Parker et al., which are exclusively directed to the generation and transmission of an ECG, for the purpose of generating and transmitting true "medical examination images." In view of the above evidence showing that those of ordinary skill in the field of medical imaging do not consider an ECG to fall into the category of a "medical examination image," Applicants respectfully submit the Examiner cannot simply conclude, without proper evidentiary support, that there is no difference between the two. Appellants respectfully submit the Examiner has not provided the proper evidentiary support required by numerous decisions of the United States Court of Appeals for the Federal Circuit indicating a motivation, inducement or guidance in any of the references of record to apply the teachings of Parker et al., which are exclusively disclosed in that reference in the context of ECG generation and transmission, to the generation and transmission of "medical examination images." In view of the significant differences between an ECG and a true "medical examination image," Appellants respectfully submit that even if a person of ordinary skill in the field of medical imaging had the insight to apply the ECG-based teachings

of Parker et al. to the field of medical imaging, this would be an insight supporting patentability, rather than a basis for negating patentability.

The Federal Circuit stated in *In re Lee* 227 F.3d 1338, 61 U.S.P.Q. 2d 1430 (Fed. Cir. 2002):

> "The factual inquiry whether to combine references must be thorough and searching. ...It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with."

Similarly, quoting *C.R. Bard, Inc. v. M3 Systems, Inc.* 157 F.3d 1340, 1352, 48 U.S.P.Q. 2d 1225, 1232 (Fed. Cir. 1998), the Federal Circuit in *Brown & Williamson Tobacco Court v. Philip Morris, Inc.,* 229 F.3d 1120, 1124-1125, 56 U.S.P.Q. 2d 1456, 1459 (Fed. Cir. 2000) stated:

> [A] showing of a suggestion, teaching or motivation to combine the prior art references is an 'essential component of an obviousness holding'.

In *In re Dembiczak,* 175 F.3d 994,999, 50 U.S.P.Q. 2d 1614, 1617 (Fed. Cir. 1999) the Federal Circuit stated:

> Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.

Consistently, in *In re Rouffet,* 149 F.3d 1350, 1359, 47 U.S.P.Q. 2d 1453, 1459 (Fed. Cir. 1998), the Federal Circuit stated:

> [E]ven when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill in the art, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious.

In *Winner International Royalty Corp. v. Wang,* 200 F.3d 1340, 1348-1349, 53 U.S.P.Q. 2d 1580, 1586 (Fed. Cir. 2000), the Federal Circuit stated:

> Although a reference need not expressly teach that the disclosure contained therein should be combined with another, ... the showing of combinability, in whatever form, must nevertheless be clear and particular.

Lastly, in *Crown Operations International, Ltd. v. Solutia, Inc.,* 289 F.3d 1367, 1376, 62 U.S.P.Q. 2d 1917 (Fed. Cir. 2002), the Federal Circuit stated:

> There must be a teaching or suggestion within the prior art, within the nature of the problem to be solved, or within the general knowledge of a person of ordinary skill in the field of the invention, to look to particular sources, to select particular elements, and to combine them as combined by the inventor.

For these reasons, even if the Examiner's statements regarding the individual teachings of the Choi reference (Exhibit "E") are accurate, Appellants respectfully submit the Examiner has not satisfied the aforementioned rigorous evidentiary standards for the Examiner's interpretation of the term "medical image" in claim 1, nor as to the alleged guidance, based on teachings in the references themselves, for combining the references in the manner proposed by the Examiner.

Claim 15, therefore, would not have been obvious to a person of ordinary skill in the field of medical system architecture design under the provisions of 35 U.S.C. §103(a), based on the teachings of Parker et al. and Choi.

Rejection of Claims 16-19 and 22 Under 35 U.S.C. §103(a) as being Unpatentable over Parker et al. in View of "Official Notice"

With regard to claim 16, the Examiner took Office Notice that the concept and advantages of using Corba technology are well known, and the Examiner took the same position with regard to Official Notice with respect to the use of instant messaging technology in claim 17, Java Enterprise Beans technology in claim 18, the use of Java Applet in a browser with regard to claim 19 and the use of a beeper with regard to claim 22. For brief descriptions of Corba and Java Beans, the Examiner cited Microsoft Computer Dictionary, 5th Ed. (Exhibit "F).

For the same reasons discussed above in connection with the rejection based on Parker et al. and Choi, Appellants respectfully submit that even if the Examiner's conclusions regarding the various items for which Official Notice has been taken are correct, the references still do not provide the rigorous evidentiary support as to teachings that would guide a person of ordinary skill in the medical architecture technology to combine the known information with the subject matter of claim 1.

Rejection of Claim 20 under 35 U.S.C. §103(a) as Unpatentable over Parker et al. in view of Shiigi

The Examiner has relied on the Shiigi reference (Exhibit "G") as teaching a WAP phone, which the Examiner acknowledges is not taught in the Parker et al. reference. Appellants acknowledge that the Shiigi reference provides such a teaching, however, for the same reasons noted above with regard to the other rejections under 35 U.S.C. §103(a), Appellants respectfully submit the Examiner has failed to satisfy the high standard of evidence required to support the position that either of the Parker et al. or Shiigi references provides teachings, motivations, inducements or guidance to a person of ordinary skill in the field of medical system architecture design, so as to justify a conclusion that it would have been obvious to such a person of ordinary skill to modify the Parker et al. reference in accordance with the disclosure of the Shiigi reference. This is particularly true, as with the other rejections under 35 U.S.C. §103(a), in view of the discussion above regarding the term "medical image" in claim 1 and the lack of a teaching thereof in the Parker et al. reference.

Rejection of Claim 21 under 35 U.S.C. §103(a) as Being Unpatentable over Parker et al. in view of Layton et al.

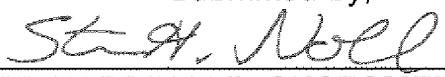
The Examiner relied on the Layton et al. reference (Exhibit "H") as teaching an SMS phone, which the Examiner acknowledged is not disclosed in the Parker et al. reference. Appellants acknowledge that the Layton et al. reference provides such a teaching, but for the reasons noted above with regard to the other rejections under 35 U.S.C. §103(a), Appellants respectfully submit the Examiner has failed to satisfy the high standard of evidence required to support the position that either of the Parker et al. or Layton et al. references provide teachings, motivations, inducements or guidance to a person of ordinary skill in the field of medical system architecture design, so as to justify a conclusion that it would have been obvious to a person of ordinary skill to modify the Parker et al. reference in accordance with the teachings of the Layton et al. reference. This is particularly true, as with the other rejections under 35 U.S.C. §103(a) in view of the discussion above regarding the term "medical image" in claim 1 and the lack of a teaching thereof in the Parker et al. reference.

CONCLUSION:

For the foregoing reasons, Appellants respectfully submit the Examiner is in error in law and in fact in rejecting claims 1-22 that are of the subject of the present Appeal. Reversal of those rejections is therefore proper, and the same is respectfully requested.

This Appeal Brief is accompanied by a request to credit the previously-paid Appeal Brief filing fee to the present Appeal Brief.

Submitted by,



(Reg. 28,982)

SCHIFF, HARDIN LLP, **CUSTOMER NO. 26574**
Patent Department
6600 Sears Tower
233 South Wacker Drive
Chicago, Illinois 60606
Telephone: 312/258-5790
Attorneys for Appellants.

CLAIMS APPENDIX

1. A medical system architecture comprising:

an imaging modality for acquiring medical examination images of an examination subject;

a workstation selected from the group of workstations consisting of workstations for acquiring said medical examination images, workstations for sending said examination image, and workstations for receiving said examination images;

a system connected to said workstation for transmitting said medical examination images to at least one location remote from said workstation; and

a call system allocated to said workstation for transmitting messages together with data representing said medical examination images to a remote location.

2. A medical system architecture as claimed in claim 1 wherein said workstation also processes data associated with said examination images, and further comprising a memory connected to said system which stores said data and said examination images in allocated fashion.

3. A medical system architecture as claimed in claim 1 wherein said call system allows manually modifiable entries of auxiliary information to ensue automatically from object types stored in a data bank.

4. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a mobile communication device.

5. A medical system architecture as claimed in claim 4 wherein said user front end is integrated in an application at said workstation.

6. A medical system architecture as claimed in claim 4 wherein said communication services comprises a communication server and a communication system.

7. A medical system architecture as claimed in claim 1 wherein said call system allows a manually modifiable entry of a message recipient to ensue automatically in said message.

8. A medical system architecture as claimed in claim 1 wherein said call system allows a manually modifiable entry of a current patient, being examined with said modality, to ensue automatically in said message.

9. A medical system architecture as claimed in claim 1 wherein said call system allows a manually modifiable entry of a current procedure being executed by said modality to ensue automatically in said message.

10. A medical system architecture as claimed in claim 1 wherein said call system allows entry of an arbitrary text as specific auxiliary information in said message.

11. A medical system architecture as claimed in claim 1 wherein said call system comprises a mobile communication device with a display.

12. A medical system architecture as claimed in claim 11 wherein said call system includes a voice input unit at said workstation allowing a voice input to be transmitted to said communication device as an audio data file, and wherein said communication device comprises an audio transducer allowing emission of said voice input at said communication device.

13. A medical system architecture as claimed in claim 1 wherein said workstation has a monitor on which said medical examination images are displayed, and wherein said call system is connected to said workstation to cause a communication window to be overlaid on said examination images at said monitor.

14. A medical system architecture as claimed in claim 1 wherein said call system comprises a mobile communication device with a display and an information return channel from said communication device to said workstation allowing information to be transmitted from said communication device to said workstation.

15. A medical system architecture as claimed in claim 14 wherein said communication device transmits a confirmation of receipt of said message to said workstation after said message has been read at said communication device.

16. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a mobile communication device, and wherein said workstation communicates with said communication service via Corba technology.

17. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a mobile communication device, and wherein said workstation communicates with said communication service via Instant Messaging technology.

18. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a mobile communication device, and wherein said workstation communicates with said communication service via Java Enterprise Beans technology.

19. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a mobile communication device, and wherein said user front end comprises a Java applet in a browser.

20. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a WAP cell phone.

21. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a SMS cell phone.

22. A medical system architecture as claimed in claim 1 wherein said call system comprises a user front end, a communication service and a beeper with a display.

RELATED APPEALS AND INTERFERENCES

None.

EVIDENCE APPENDIX

Exhibit A: McGraw-Hill Dictionary of Scientific and Technical Terms, 5th Ed., Parker (Editor in Chief (1994)) - submitted with January 17, 2006 Amendment that was entered upon the filing of the RCE on May 2, 2006.

Exhibit B: "Foundations of Medical Imaging," Cho et al. (1993) pages 3-5 - submitted with January 17, 2006 Amendment that was entered upon the filing of the RCE on May 2, 2006.

Exhibit C: "Principles of Medical Imaging," Shung et al. (1992) pages xiii - xiv - submitted with January 17, 2006 Amendment that was entered upon the filing of the RCE on May 2, 2006.

Exhibit D: United States Patent No. 6,321,113 (Parker et al.) - cited in the Final Rejection dated June 26, 2006.

Exhibit E: United States Patent No. 6,629,131 (Choi) - cited in the Final Rejection dated June 26, 2006.

Exhibit F: Microsoft Computer Dictionary, 5th Ed. - cited in the Final Rejection dated June 26, 2006.

Exhibit G: United States Patent No. 6,304,898 (Shiigi) - cited in the Final Rejection dated June 26, 2006.

Exhibit H: United States Patent No. 6,829,478 (Layton et al.) - cited in the Final Rejection dated June 26, 2006.

Exhibit I: Request for Continued Examination (RCE) Transmittal - filed May 2, 2006.

Exhibit J: Figs. 1-3 - filed as part of the original application on November 19, 2001.

McGraw-Hill Dictionary of Scientific and Technical Terms

Fifth Edition

Sybil P. Parker
Editor in Chief

McGraw-Hill, Inc.
New York San Francisco Washington, D.C.
Auckland Bogotá Caracas Lisbon London Madrid Mexico City Milan
Montreal New Delhi San Juan Singapore Sydney Tokyo Toronto

On the cover: Photomicrograph of crystals of vitamin B_1.
(*Dennis Kunkel, University of Hawaii*)

Included in this Dictionary are definitions which have been published previously in the following works: P. B. Jordain, *Condensed Computer Encyclopedia*, Copyright © 1969 by McGraw-Hill, Inc. All rights reserved. J. Markus, *Electronics and Nucleonics Dictionary*, 4th ed., Copyright © 1960, 1966, 1978 by McGraw-Hill, Inc. All rights reserved. J. Quick, *Artists' and Illustrators' Encyclopedia*, Copyright © 1969 by McGraw-Hill, Inc. All rights reserved. *Blakiston's Gould Medical Dictionary*, 3d ed., Copyright © 1956, 1972 by McGraw-Hill, Inc. All rights reserved. T. Baumeister and L. S. Marks, eds., *Standard Handbook for Mechanical Engineers*, 7th ed., Copyright © 1958, 1967 by McGraw-Hill, Inc. All rights reserved.

In addition, material has been drawn from the following references: R. E. Huschke, *Glossary of Meteorology*, American Meteorological Society, 1959; *U.S. Air Force Glossary of Standardized Terms*, AF Manual 11-1, vol. 1, 1972; *Communications-Electronics Terminology*, AF Manual 11-1, vol. 3, 1970; W. H. Allen, ed., *Dictionary of Technical Terms for Aerospace Use*, 1st ed., National Aeronautics and Space Administration, 1965; J. M. Gilliland, *Solar-Terrestrial Physics: A Glossary of Terms and Abbreviations*, Royal Aircraft Establishment Technical Report 67158, 1967; *Glossary of Air Traffic Control Terms*, Federal Aviation Agency; *A Glossary of Range Terminology, White Sands Missile Range, New Mexico*, National Bureau of Standards, AD 467-424; *A DOD Glossary of Mapping, Charting and Geodetic Terms*, 1st ed., Department of Defense, 1967; P. W. Thrush, comp. and ed., *A Dictionary of Mining, Mineral, and Related Terms*, Bureau of Mines, 1968; *Nuclear Terms: A Glossary*, 2d ed., Atomic Energy Commission; F. Casey, ed., *Compilation of Terms in Information Sciences Technology*, Federal Council for Science and Technology, 1970; *Glossary of Stinfo Terminology*, Office of Aerospace Research, U.S. Air Force, 1963; *Naval Dictionary of Electronic, Technical, and Imperative Terms*, Bureau of Naval Personnel, 1962; *ADP Glossary*, Department of the Navy, NAVSO P-3097.

5 6 7 8 9 0 DOW/DOW 9 9

ISBN 0-07-042333-4

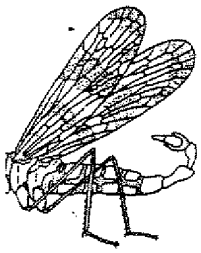
Library of Congress Cataloging-in-Publication Data

McGraw-Hill dictionary of scientific and technical terms /
Sybil P. Parker, editor in chief..—5th ed.
p. cm.
ISBN 0-07-042333-4
1. Science—Dictionaries. 2. Technology—Dictionaries.
I. Parker, Sybil P.
Q123.M34 1993
503—dc20 93-34772
CIP

INTERNATIONAL EDITION

When ordering this title, use ISBN 0-07-113584-7.

ECOPTERA



2 mm

on fly (*Panorpa*).

in the fetal intestine, becoming the first fecal discharge of the newborn. { mə'kō·nē·əm }

meconium ileus [MED] Intestinal obstruction in the newborn with cystic fibrosis due to trypsin deficiency. { mə'kō·nē·əm 'il·ē·əs }

Mecoptera [INV ZOO] The scorpion flies, a small order of insects; adults are distinguished by the peculiar prolongation of the head into a beak, which bears chewing mouthparts. { me'käp·tə·rə }

mecystasis [PHYSIO] Increase in muscle length with maintenance of the original degree of tension. { me'sis·tə·səs }

media [HISTOL] The middle, muscular layer in the wall of a vein, artery, or lymph vessel. { 'mē·dē·ə }

media conversion [COMPUT SCI] The transfer of data from one storage type (such as punched cards) to another storage type (such as magnetic tape). { 'mē·dē·ə kən,vər·zhən }

media conversion buffer [COMPUT SCI] Large storage area, such as a drum, on which data may be stored at low speed during nonexecution time, to be later transferred at high speed into core memory during execution time. { 'mē·dē·ə kən,vər·zhən ,bəf·ər }

mediad [ANAT] Toward the median line or plane of the body or of a part of the body. { 'mē·dē,ad }

medial [ANAT] **1.** Being internal as opposed to external (lateral). **2.** Toward the midline of the body. [SCI TECH] Located in the middle. { 'mē·dē·əl }

medial arteriosclerosis [MED] Calcification of the tunica media of small and medium-sized muscular arteries. Also known as medial calcinosis; Mönckeberg's arteriosclerosis. { 'mē·dē·əl ,är·tir·ē·ō·skli·ə'rō·səs }

medial calcinosis *See* medial arteriosclerosis. { 'mē·dē·əl ,kal·sə'nō·səs }

medial lemniscus [ANAT] A lemniscus arising in the nucleus gracilis and nucleus cuneatus of the brain, crossing immediately as internal arcuate fibers, and terminating in the posterolateral ventral nucleus of the thalamus. { 'mē·dē·əl lem'nis·kəs }

medial moraine [GEOL] **1.** An elongate moraine carried in or upon the middle of a glacier and parallel to its sides. **2.** A moraine formed by glacial abrasion of a rocky protuberance near the middle of a glacier. { 'mē·dē·əl mə'rān }

medial necrosis [MED] Death of cells in the tunica media of arteries. Also known as medionecrosis. { 'mē·dē·əl ne'krō·səs }

media migration [CHEM ENG] Carryover of fibers or other filter material by liquid effluent from a filter unit. { 'mē·dē·ə mī'grā·shən }

median [MATH] **1.** Any line in a triangle which joins a vertex to the midpoint of the opposite side. **2.** The line that joins the midpoints of the nonparallel sides of a trapezoid. Also known as midline. [SCI TECH] Located in the middle. [STAT] An average of a series of quantities or values; specifically, the quantity or value of that item which is so positioned in the series, when arranged in order of numerical quantity or value, that there are an equal number of items of greater magnitude and lesser magnitude. { 'mē·dē·ən }

median effective dose *See* effective dose 50. { 'mē·dē·ən i'fek·tiv 'dōs }

median infective dose *See* infective dose 50. { 'mē·dē·ən in'fek·tiv 'dōs }

median lethal dose *See* lethal dose 50. { 'mē·dē·ən 'lēth·əl 'dōs }

median lethal time [MICROBIO] The period of time required for 50% of a large group of organisms to die following a specific dose of an injurious agent, such as a drug or radiation. { 'mē·dē·ən 'lēth·əl ,tīm }

median mass [GEOL] A less disturbed structural block in the middle of an orogenic belt, bordered on both sides by orogenic structure, thrust away from it. Also known as betwixt mountains; Zwischengebirge. { 'mē·dē·ən 'mas }

median maxillary cyst [MED] Cystic dilation of embryonal inclusions in the incisive fossa or between the roots of the central incisors. Also known as nasopalatine cyst. { 'mē·dē·ən 'mak·sə,ler·ē ,sist }

median nasal process [EMBRYO] The region below the frontonasal sulcus between the olfactory sacs; forms the bridge and mobile septum of the nose and various parts of the upper jaw and lip. { 'mē·dē·ən 'nāz·əl ,prä·səs }

median nerve test [MED] A test for loss of function of the median nerve by having the patient abduct the thumb at right angles to the palm with fingertips in contact and forming a pyramid. { 'mē·dē·ən 'nərv ,test }

median particle diameter [GEOL] The middlemost particle diameter of a rock or sediment, larger than 50% of the diameters in the distribution and smaller than the other 50%. { 'mē·dē·ən 'pärd·ə·kəl dī,am·əd·ər }

median point [MATH] The point at which all three medians of a triangle intersect. { 'mē·dē·ən ,point }

median strip [CIV ENG] A paved or planted section dividing a highway into lanes according to direction of travel. { 'mē·dē·ən 'strip }

mediastinitis [MED] Inflammation of the mediastinum. { ,mē·dē,as·tə'nīd·əs }

mediastinum [ANAT] **1.** A partition separating adjacent parts. **2.** The space in the middle of the chest between the two pleurae. { ,mē·dē·ə'stī·nəm }

medical bacteriology [MED] A branch of medical microbiology that deals with the study of bacteria which affect human health, especially those which produce disease. { 'med·ə·kəl bak,tir·ē'äl·ə·jē }

medical chemical engineering [CHEM ENG] The application of chemical engineering to medicine, frequently involving mass transport and separation processes, especially at the molecular level. { 'med·ə·kəl 'kem·ə·kəl ,en·jə'nir·iŋ }

medical climatology [MED] The study of the relation between climate and disease. { 'med·ə·kəl ,klī·mə'täl·ə·jē }

medical electronics [ELECTR] A branch of electronics in which electronic instruments and equipment are used for such medical applications as diagnosis, therapy, research, anesthesia control, cardiac control, and surgery. { 'med·ə·kəl i,lek'trän·iks }

medical entomology [MED] The study of insects that are vectors for diseases and parasitic infestations in humans and domestic animals. { 'med·ə·kəl ,en·tə'mäl·ə·jē }

medical ethics [MED] Principles and moral values of proper medical conduct. { 'med·ə·kəl 'eth·iks }

medical examiner [MED] A professionally qualified physician duly authorized and charged by a governmental unit to determine facts concerning causes of death, particularly deaths not occurring under natural circumstances, and to testify thereto in courts of law. { 'med·ə·kəl ig'zam·ə·nər }

medical frequency bands [COMMUN] A collection of radio frequency bands allocated to medical equipment in the United States. { 'med·ə·kəl 'frē·kwən·sē ,banz }

medical genetics [GEN] A field of human genetics concerned with the relationship between heredity and disease. { 'med·ə·kəl jə'ned·iks }

medical geography [MED] The study of the relation between geographic factors and disease. { 'med·ə·kəl jē'äg·rə·fē }

medical history [MED] An account of a patient's past and present state of health obtained from the patient or relatives. { 'med·ə·kəl 'his·trē }

medical imaging [MED] The production of visual representations of body parts, tissues, or organs, for use in clinical diagnosis; encompasses x-ray methods, magnetic resonance imaging, single-photon-emission and positron-emission tomography, and ultrasound. { 'med·ə·kəl 'im·ij·iŋ }

medical microbiology [MED] The study of microorganisms which affect human health. { 'med·ə·kəl ¦mī·krō·bī'äl·ə·jē }

medical mycology [MED] A branch of medical microbiology that deals with fungi that are pathogenic to humans. { 'med·ə·kəl mī'käl·ə·jē }

medical parasitology [MED] A branch of medical microbiology which deals with the relationship between humans and those animals which live in or on them. { 'med·ə·kəl ,par·ə·si'täl·ə·jē }

medical protozoology [MED] A branch of medical microbiology that deals with the study of Protozoa which are parasites of humans. { 'med·ə·kəl ,prō·dō·zō'äl·ə·jē }

medical radiography [MED] The use of x-rays to produce photographic images for visualizing internal anatomy as an aid in diagnosis. { 'med·ə·kəl ,rād·ē·'äg·rə·fē }

medication [MED] **1.** A medicinal substance. **2.** Treatment by or administration of a medicine. { ,med·ə'kā·shən }

medicinal [MED] Of, pertaining to, or having the nature of medicine. { mə'dis·ən·əl }

medicinal oil [MATER] A highly refined, colorless, tasteless and odorless petroleum oil used medicinally as an internal lu-

FOUNDATIONS OF MEDICAL IMAGING

Z. H. Cho

University of California
Irvine, CA
Korea Advanced Institute of Science
Seoul, Korea

Joie P. Jones

University of California
Irvine, CA

Manbir Singh

University of Southern California
Los Angeles, CA

A WILEY-INTERSCIENCE PUBLICATION

JOHN WILEY & SONS, INC.

New York / Chichester / Brisbane / Toronto / Singapore

This text is printed on acid-free paper.

Library of Congress Cataloging in Publication Data:

Cho, Z.-H. (Zang-Hee), 1936–

Foundations of medical imaging / Z. H. Cho, Joie P. Jones, Manbir Singh.

p. cm

"A Wiley-Interscience publication."

Includes index.

ISBN 0-471-54573-2 (cloth)

1. Diagnostic imaging. I. Jones, Joie P. II. Singh, Manbir. III. Title.

RC78.7.D53C48 1993

616.07'54–dc20 92-26906

Printed in the United States of America

10 9 8 7 6 5 4 3 2

This book is,
years with the
California, Irv
sity of Southe
Since the i
ago, medical
imaging techn
tion of CT cre
classical two-d
sional format.
since been uti
of imaging mc
ment. Today
magnetic reso
medical imag
medicine. Cor
to be involved
this emerging
Because of
it is imperativ
pline. Our go
understanding.
clude the basi
interaction pa
associated wit
Historically
disciplines, eac
to provide the
and unified vie
will help medic
The book is
Part I, include
with a commo

1

INTRODUCTION

The study of medical imaging is concerned with the interaction of all forms of radiation with tissue and the development of appropriate technology to extract clinically useful information from observations of this interaction. Such information is usually displayed in an image format. Medical images can be as simple as a projection or shadow image—as first produced by Röntgen nearly 100 years ago and utilized today as a simple chest X-ray—or as complicated as a computer reconstructed image—as produced by computerized tomography (CT) using X-rays or by magnetic resonance imaging (MRI) using intense magnetic fields.

Although, strictly speaking, medical imaging began in 1895 with Röntgen's discoveries of X-rays and of the ability of X-rays to visualize bones and other structures within the living body [1], contemporary medical imaging began in the 1970s with the advent of computerized tomography [2, 3]. Early, or what we call *classical*, medical imaging utilizes images that are a direct manifestation of the interaction of some form of radiation with tissue. Three examples will illustrate what we mean by classical imaging. First is the conventional X-ray procedure in which a beam of X-rays is directed through the patient onto a film. The developed film provides a shadow image of the patient which is a direct representation of the passage of X-rays through the body. Although such images are not quantitative, they do provide some measure of the attenuation of X-rays in tissue. Thus a section of soft tissue will appear darker than an equally thick section of bone, which attenuates more of the X-rays. It should be noted that even with current technological developments

conventional X-ray imaging still represents the major imaging procedure at most medical facilities.

As a second example of classical imaging, consider a conventional nuclear medicine procedure. Here a radioactive material is injected into the patient and its course followed by a detector which is moved over the patient in a specified manner. Although the image recorded by the detector generally has poor spatial resolution, its real advantage is that it provides a measure of physiological function from the time course of the radioisotope uptake. Clearly the conventional nuclear medicine image is a direct measure of the location and concentration of the radioactive isotope used.

As a final example of classical imaging, consider conventional medical ultrasound. Here, a pulse of ultrasonic energy is propagated into the patient and the backscattered echo signal is recorded by the same transducer. By angulating or moving the transducer (or by using a transducer array) positionally sequential echo signals are recorded, and a cross-sectional image of the subject is displayed directly on a video monitor. Ultrasound images are really a mapping of echo intensities and are a direct result of the interaction of the ultrasound pulse with tissue.

In this text we will define modern or contemporary medical imaging operationally as a two-part process: (1) the collection of data concerning the interaction of some form of radiation with tissue, and (2) the transformation of these data into an image (or a set of images) using specific mathematical methods and computational tools. Note that our definitions for both classical and modern imaging are consistent with our general definition of medical imaging, given in the first paragraph of this chapter. Note also that modern imaging can be represented as a generalization of classical imaging and that classical imaging is simply a special case of modern imaging in which the image forms directly from the interaction process. Whereas classical imaging is direct and intuitive, modern imaging is indirect and, in many cases, counter intuitive. Since modern images are formed by processing, reformulating, or reconstructing an image from the tissue/radiation interaction data base, the process is often referred to as "reconstruction" and the image as a "reconstructed image."

The first device capable of producing true reconstructed images was developed by G. N. Hounsfield [2] in 1972 at EMI in England. Hounsfield's X-ray computerized tomograph device was based in part on mathematical methods developed by A. M. Cormack [4] a decade earlier. For their efforts Hounsfield and Cormack were awarded the Nobel Prize in medicine in 1979. Put quite simply, CT imaging is based on the mathematical formalism that states that if an object is viewed from a number of different angles, then a cross-sectional image of it can be computed (or "reconstructed"). Thus X-ray CT yields an image that is essentially a mapping of X-ray attenuation or tissue density.

The introduction of X-ray CT in 1972 represents the real beginning of modern imaging and has altered forever our concept of imaging as merely

Table 1-1 3-D

2-D and 3-D Projection Reconstructi
Iterative Method
Fourier Reconstructi

taking a picture. It
making quantitativ
tomography to conv
ment of two new
tomography (SPEC
applications to the
(NMR) has led to
currently being e
impedance tomogr
Inherent to the dev
development of n
Table 1-1.

In this chapter v
various medical ima
techniques are show
interrogation wavel
ceeding chapters w
imaging modalities.
sity, be treated sep
field of medical ima

1-1 THE BEGINN

The history of med
Wilhelm Konrad R

Table 1-1 3-D image reconstruction algorithms

2-D and 3-D Projection Reconstruction	2-D Projection Reconstruction	Parallel-Beam Mode
		Fan-Beam Mode
	3-D Projection Reconstruction	Parallel-Beam Mode
		Cone-Beam Mode
Iterative Method	Algebraic Reconstruction Technique (ART)	
	Maximum Likelihood Reconstruction (MLR) or Expectation Maximization (EM) Reconstruction	
Fourier Reconstruction	Direct Fourier Reconstruction (DFR)	
	Direct Fourier Imaging (DFI) in NMR	

taking a picture. It has also led to the development of 3-D imaging and is making quantitative imaging a reality. The application of reconstructive tomography to conventional nuclear medicine imaging has led to the development of two new imaging modalities: single photon emission computed tomography (SPECT) and positron emission tomography (PET). Similar applications to the laboratory technique of nuclear magnetic resonance (NMR) has led to magnetic resonance imaging (MRI). The CT concept is currently being extended to 3-D magnetoencephalography, electrical impedance tomography, and photon migration tomography, to name a few. Inherent to the development of these new imaging modalities has been the development of new reconstruction techniques, which are detailed in Table 1-1.

In this chapter we seek to provide a brief historical perspective for the various medical imaging modalities that are currently important. The various techniques are shown in Figs. 1-1 and 1-2 where they are characterized by the interrogation wavelengths. A parallel sequence will be followed in the succeeding chapters which provide more detailed discussions of the various imaging modalities. Although the various imaging techniques will, of necessity, be treated separately, our goal is to provide a unified approach to the field of medical imaging.

1-1 THE BEGINNING WITH X-RAYS

The history of medical imaging really began on November 8, 1895, when Wilhelm Konrad Röntgen reported the discovery of what he called "a new

Principles of Medical Imaging

K. Kirk Shung

Department of Bioengineering
Pennsylvania State University
University Park, Pennsylvania

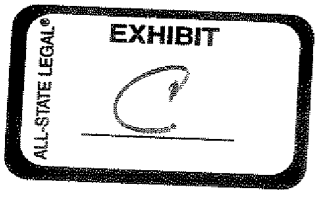
Michael B. Smith

Department of Radiology
Milton S. Hershey Medical Center
Pennsylvania State University
Hershey, Pennsylvania

Benjamin M. W. Tsui

Departments of Biomedical Engineering and Radiology
University of North Carolina at Chapel Hill
Chapel Hill, North Carolina

Academic Press, Inc.
Harcourt Brace Jovanovich, Publishers
San Diego New York Boston London Sydney Tokyo Toronto



Cover photograph courtesy of Michael B. Smith. A computer model of the human head showing the naturally occuring magnetic field gradients found in all normal humans when exposed to a homogeneous, static magnetic field of 1 tesla. Each contour line describes a field change of 0.3 parts per million. The differences in the magnetic field are due to the magnetic susceptibility of the air–tissue interface associated with the sinus cavities in the head.

This book is printed on acid-free paper. ♾

Academic Press, Inc.
1250 Sixth Avenue, San Diego, California 92101-4311

United Kingdom Edition published by
Academic Press Limited
24–28 Oval Road, London NW1 7DX

Library of Congress Cataloging-in-Publication Data

Shung, K. Kirk.
Principles of medical imaging / K. Kirk Shung, Michael B. Smith, Benjamin Tsui.
Includes bibliographical references and index
p. cm.
ISBN 0-12-640970-6
1. Diagnostic imaging. 2. Medical physics. I. Smith, Michael B. (Michael Bruce), date. II. Tsui, Benjamin. III. Title.
[DNLM: 1. Biophysics. 2. Diagnostic Imaging--instrumentation. WN 200 S562p]
RC78.7.D53S52 1992
616.07'54--dc20
DNLM/DLC
for Library of Congress 92-7143
CIP

PRINTED IN THE UNITED STATES OF AMERICA
92 93 94 95 96 QW 9 8 7 6 5 4 3 2 1

Preface

The field of medical imaging is growing at a rapid pace. Since the early 1960s, three new imaging modalities, namely, radionuclide imaging, ultrasound, and magnetic resonance imaging, have appeared and matured. Along with X-ray they are among the most important clinical diagnostic tools in medicine today. Radionuclide imaging, although its resolution cannot match that of other modalities, uses radioactive isotopes attached to biochemically active substances to yield unique information about the biochemical or physiological function of the organ which is unattainable otherwise. Ultrasound scanners use high frequency sound waves to interrogate the interior of the body. They are capable of depicting anatomical details with excellent resolution. Ultrasound is particulary suited to situations where exposure to ionizing radiation is undesirable, such as in obstetrical and neonatal scanning, and to imaging structures in motion, such as heart valves. Magnetic resonance imaging, however, has been envisioned to be the most exciting of them all by far because it also uses a form of nonionizing radiation, can achieve superior resolution, and is capable of yielding physiological information. In this period, significant progress has also been achieved in conventional X-ray radiography. Improved design or introduction of better materials in image intensifiers, intensifying and fluoroscopic screens, and photographic films has enhanced the resolution to a significant degree without adding higher patient radiation exposure levels. It is therefore plausible to understand why conventional radiography is still routinely used clinically for the diagnosis of many diseases and is the gold standard to which newer imaging modalities are compared.

Unquestionably, the digital revolution is the primary reason that has caused the medical imaging field to experience the explosive growth that we are seeing today. Computer and digital technology along with advances in electronics have made data acquisition fast and mass data storage possible. These are the most essential ingredients for the practical realization of tomographical reconstruction principles. X-ray computed tomography (CT), digital radiography, real-time ultrasonic scanners, single-photon emission computed tomography (SPECT), positron emission tomography (PET), and magnetic resonance imaging (MRI), which came about after the early 1970s, are just a few well-known products of the digital revolution in medical imaging.

While the development of these new imaging approaches may have contributed greatly to the improvement of health care, it has also contributed to the rising cost of health care. A chest X-ray costs only $20–30 per procedure whereas a magnetic resonance scan may cost up to $1000, let alone the expenses associated with acquiring and installing such a scanner. The cost-to-benefit ratio for

these expensive procedures in certain cases is sometimes not as clear as in others. Therefore it is not unusual that the clinical efficacy and contribution of these modalities to patient care are being scrutinized and debated constantly by the medical community as well as the public.

This book is intended to be a university textbook for a senior or first-year graduate level course in medical imaging offered in a biomedical engineering, electrical engineering, medical physics, or radiological sciences department. Much of the material is calculus based. However, an attempt has been made to minimize mathematical derivation and to place more emphasis on physical concepts. A major part of this book was derived from notes used by the authors to teach a graduate course in medical imaging at the Bioengineering Program of Pennsylvania State University since the late 1970s. This book covers all four major medical imaging modalities, namely, X-ray including CT and digital radiography, ultrasound, radionuclide imaging including SPECT and PET, and magnetic resonance imaging. It is divided into four chapters in which a similar format is used. In each chapter fundamental physics involved in a modality is given first, followed by a discussion on instrumentation. Then various diagnostic procedures are described. Finally, recent developments and biological effects of each modality are discussed. At the end of each chapter a list of relevant references, further reading materials, and a set of problems are given. The purpose of this textbook is to give students with an adequate background in mathematics and physics an introduction to the field of diagnostic imaging; the materials discussed should be more than sufficient for one semester. However, the book may also be used as the text for a two-semester course in medical imaging when supplemented by additional materials or by inclusion of more mathematic detail.

Although this book has been written as a college textbook, radiologists with some technical background and practicing engineers or physicists working in imaging industries should also find it a valuable reference in the medical imaging field. As a final note, it should be pointed out that there are other imaging methods that have been used in medicine [e.g., thermography, magnetic imaging, and microwave imaging (Hendee, 1991)]. They are not included in this book primarily due to their limited utility at present. Readers who are interested in these modalities may refer to several books listed in the following reference section.

References and Further Reading

Barrett, H., and Swindell, W. (1981). "Radiological Imaging: The Theory of Image Formation, Detection, and Processing." Academic Press, New York.

Curry, T. S. III, Dowdey, J. E., and Murry, R. C. Jr. (1990). "Christensen's Introduction to the Physics of Diagnostic Radiology, 4th Edition." Lea and Febiger, Philadelphia.

Freeman, S. E., Fukushima, E., and Greene, E. R. (1990), "Noninvasive Techniques in Biology and Medicine." San Francisco Press, San Francisco.

Hendee, W. R. (1991). *Diagnostic Imaging* **13**, A13.

Huang, H. K. (1987). "Elements of Digital Radiology." Prentice-Hall, Englewood Cliffs, New Jersey.

Jaffe, C. C. (1982). *Am. Scient.* **70**, 576.

Krestel, E. (1990). "Imaging Systems for Medical Diagnosis." Siemens, Aktiengesellschaft, Germany.

Larsen, L. E., and Jacobi, J. H. (1985). "Medical Applications of Microwave Imaging." IEEE Press, New York.

Mackay, R. S. (1984). "Medical Images and Display." John Wiley, New York.

US006321113B1

(12) **United States Patent**
Parker et al.

(10) **Patent No.: US 6,321,113 B1**
(45) **Date of Patent: Nov. 20, 2001**

(54) **AUTOMATIC EXTERNAL DEFIBRILLATOR FIRST RESPONDER AND CLINICAL DATA OUTCOME MANAGEMENT SYSTEM**

(75) Inventors: **William S. Parker**, Maple Grove; **Patrick J. Splinter**; **Sarah M. Lindseth**, both of Eden Prairie; **Matthew G. Bradley**, Mankato, all of MN (US)

(73) Assignee: **SurVivaLink Corporation**, Minneapolis, MN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/281,076**

(22) Filed: **Mar. 30, 1999**

Related U.S. Application Data

(60) Provisional application No. 60/080,130, filed on Mar. 31, 1998.

(51) **Int. Cl.**[7] **A61N 1/39**
(52) **U.S. Cl.** **607/5**
(58) **Field of Search** 607/5, 300; 600/523; 128/903, 920

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,925,762		12/1975	Heitlinger et al. .
4,216,462		8/1980	McGrath et al. .
4,281,330		7/1981	Warrick .
4,290,114	*	9/1981	Sinay 128/920
4,319,241	*	3/1982	Mount 128/903
4,715,385		12/1987	Cudahy et al. .
4,895,161		1/1990	Cudahy et al. .
5,243,975		9/1993	Alferness et al. .
5,345,552		9/1994	Brown .
5,456,261		10/1995	Luczyk .
5,549,115		8/1996	Morgan et al. .
5,549,659		8/1996	Johansen et al. .
5,593,426		1/1997	Morgan et al. .
5,680,864		10/1997	Morgan et al. .
5,716,380		2/1998	Yerkovich et al. .

FOREIGN PATENT DOCUMENTS

WO 96/14620 5/1996 (WO) .

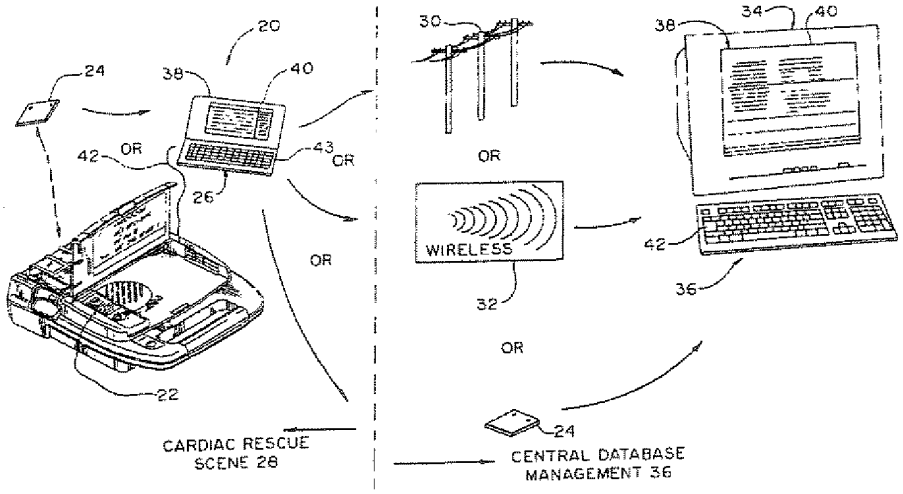
* cited by examiner

Primary Examiner—William E. Kamm
(74) *Attorney, Agent, or Firm*—Patterson, Thuente, Skaar & Christensen, P.A.

(57) **ABSTRACT**

A method and system for managing cardiac rescue events is disclosed. Unlike prior systems, this method and system uses a rescue scene computer to obtain patient and incident data at the rescue scene and then marry that data with ECG rescue data and automated external defibrillator (AED) rescue data. All of this data is then simultaneously transmitted to a base computer at an emergency medical center for review. Accordingly, a reviewer at the base computer can immediately review the ECG and AED performance in context with patient and incident data. The method and system includes a Windows-based single screen graphical user interface for entering and reviewing the data and particularly includes a window for viewing ECG data simultaneously with entry and review of all other data available in the single screen user interface. The system and method comprises one or more of the following elements including a base computer, a portable rescue scene computer, an automated external defibrillator (AED), and a communication link for linking the rescue scene computer to the base computer and/or the AED. The system and method further includes software that is programmed in the base computer and rescue scene computer to operate the single screen user interface and database.

16 Claims, 17 Drawing Sheets



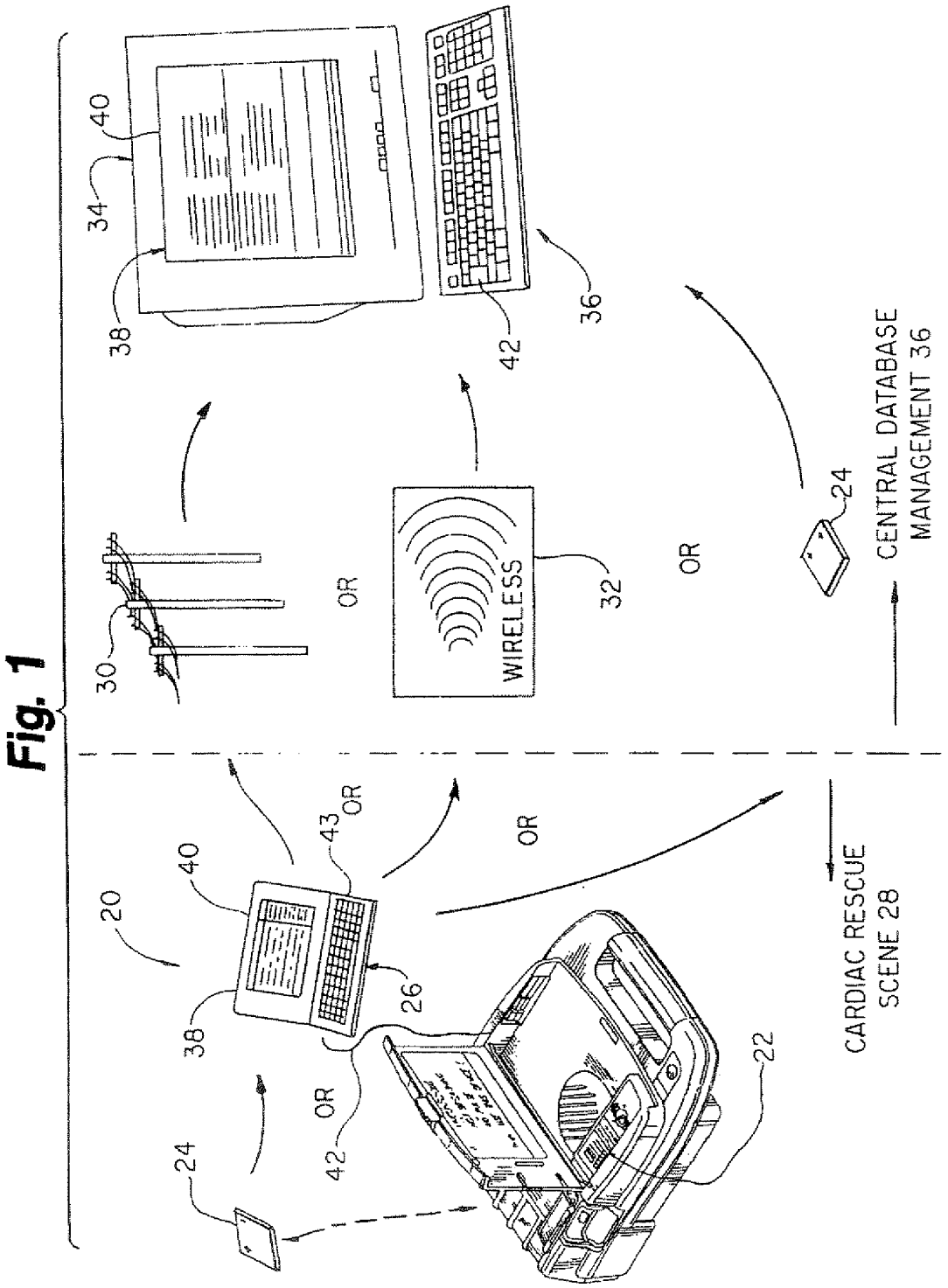

CENTRAL DATABASE MANAGEMENT 36
CARDIAC RESCUE SCENE 28
WIRELESS
OR
20
22
24
26
30
32
34
36
38
40
42
43

Fig. 1

Fig. 2A

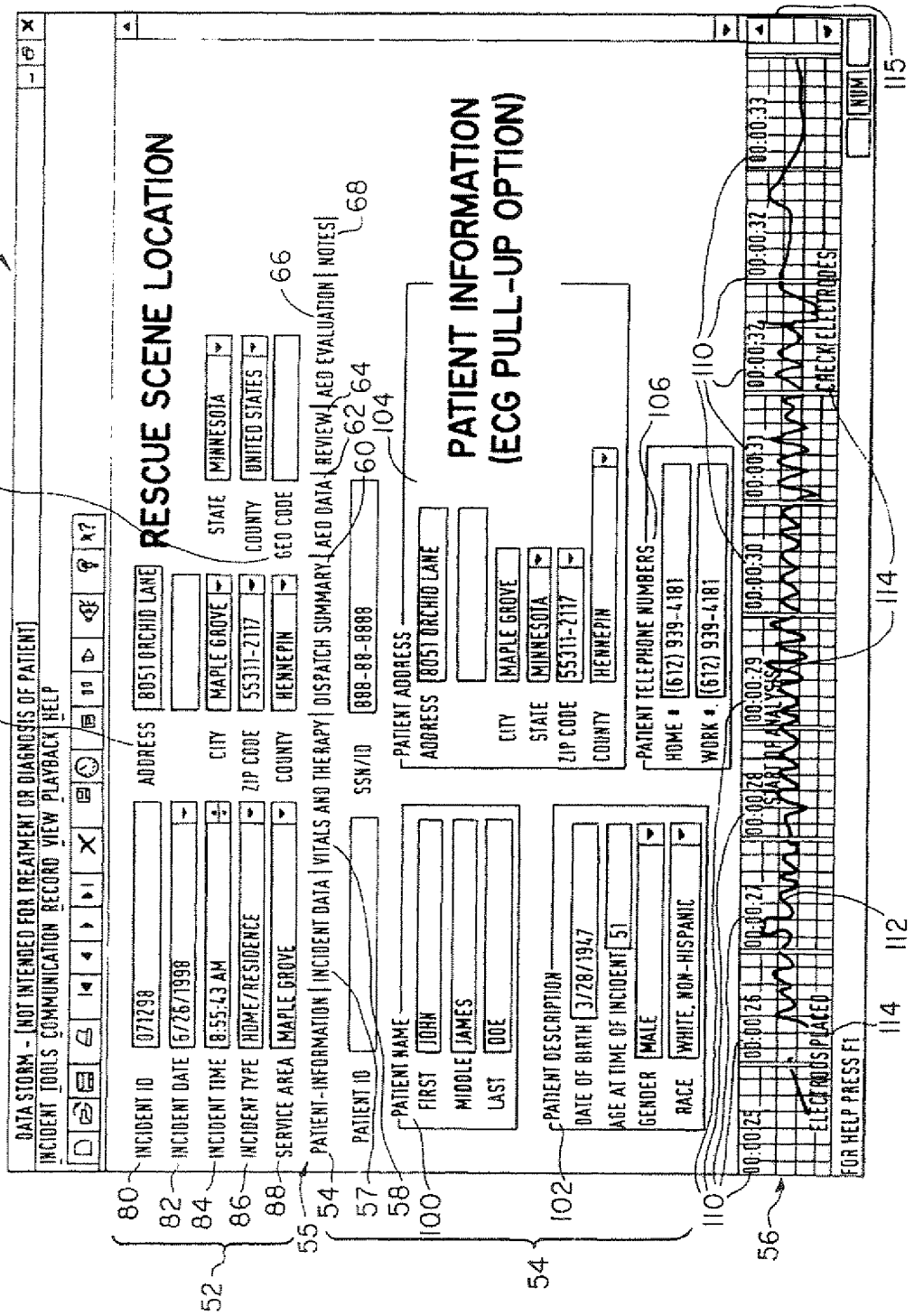

DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATION RECORD VIEW PLAYBACK HELP
RESCUE SCENE LOCATION
PATIENT INFORMATION (ECG PULL-UP OPTION)
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
STATE MINNESOTA
COUNTY UNITED STATES
GEO CODE
PATIENT-INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA | REVIEW | AED EVALUATION | NOTES
PATIENT ID
SSN/ID 888-88-8888
PATIENT NAME
FIRST JOHN
MIDDLE JAMES
LAST DOE
PATIENT DESCRIPTION
DATE OF BIRTH 3/28/1947
AGE AT TIME OF INCIDENT 51
GENDER MALE
RACE WHITE, NON-HISPANIC
PATIENT ADDRESS
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
STATE MINNESOTA
ZIP CODE 55311-2117
COUNTY HENNEPIN
PATIENT TELEPHONE NUMBERS
HOME # (612) 939-4181
WORK # (612) 939-4181
START DATA ANALYSIS
CHECK ELECTRODES
ELECTRODES DISPLACED
FOR HELP PRESS F1
NUM
00:00:25
00:00:26
00:00:27
00:00:28
00:00:29
00:00:30
00:00:31
00:00:32
00:00:33
00:00:34
50
52
54
55
56
57
58
60
62
64
66
68
80
82
84
86
88
90
92
100
102
104
106
110
112
114
115

Fig. 2B

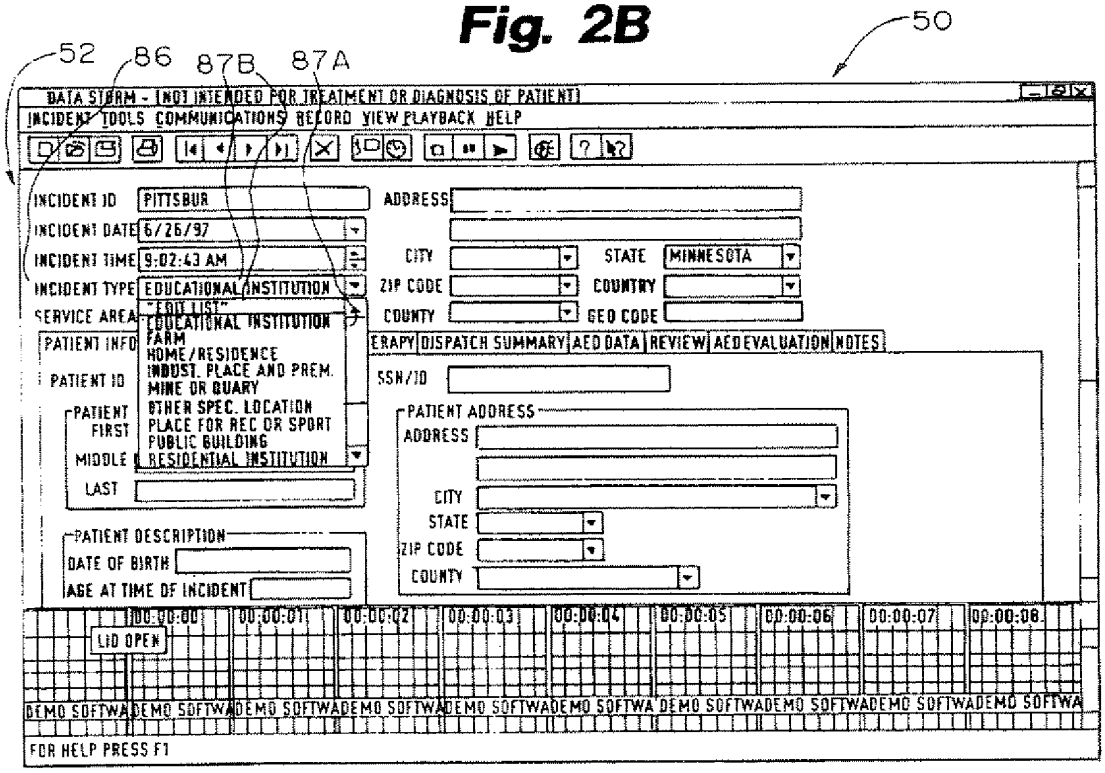

50
52
86
87B
87A
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
INCIDENT ID
PITTSBUR
INCIDENT DATE
6/26/97
INCIDENT TIME
9:02:43 AM
INCIDENT TYPE
EDUCATIONAL INSTITUTION
SERVICE AREA
"EDIT LIST"
EDUCATIONAL INSTITUTION
FARM
HOME/RESIDENCE
INDUST. PLACE AND PREM.
MINE OR QUARY
OTHER SPEC. LOCATION
PLACE FOR REC OR SPORT
PUBLIC BUILDING
RESIDENTIAL INSTITUTION
ADDRESS
CITY
STATE
MINNESOTA
ZIP CODE
COUNTRY
COUNTY
GEO CODE
PATIENT INFO
ERAPY
DISPATCH SUMMARY
AED DATA
REVIEW
AED EVALUATION
NOTES
PATIENT ID
SSN/ID
PATIENT FIRST
MIDDLE
LAST
PATIENT ADDRESS
ADDRESS
CITY
STATE
ZIP CODE
COUNTY
PATIENT DESCRIPTION
DATE OF BIRTH
AGE AT TIME OF INCIDENT
00:00:00
00:00:01
00:00:02
00:00:03
00:00:04
00:00:05
00:00:06
00:00:07
00:00:08
LID OPEN
DEMO SOFTWA
FOR HELP PRESS F1

Fig. 2C

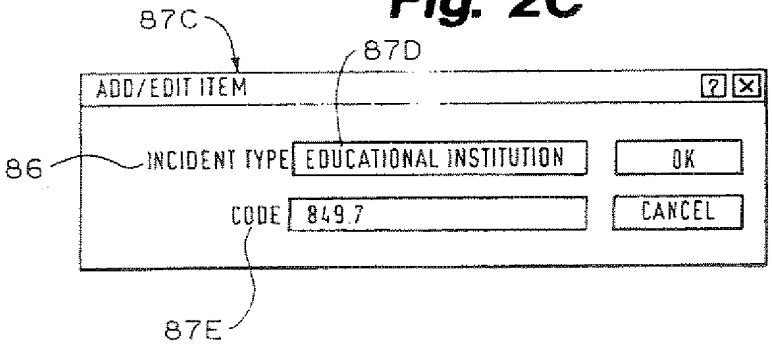

87C
87D
ADD/EDIT ITEM
86
INCIDENT TYPE
EDUCATIONAL INSTITUTION
OK
CODE
849.7
CANCEL
87E

Fig. 3

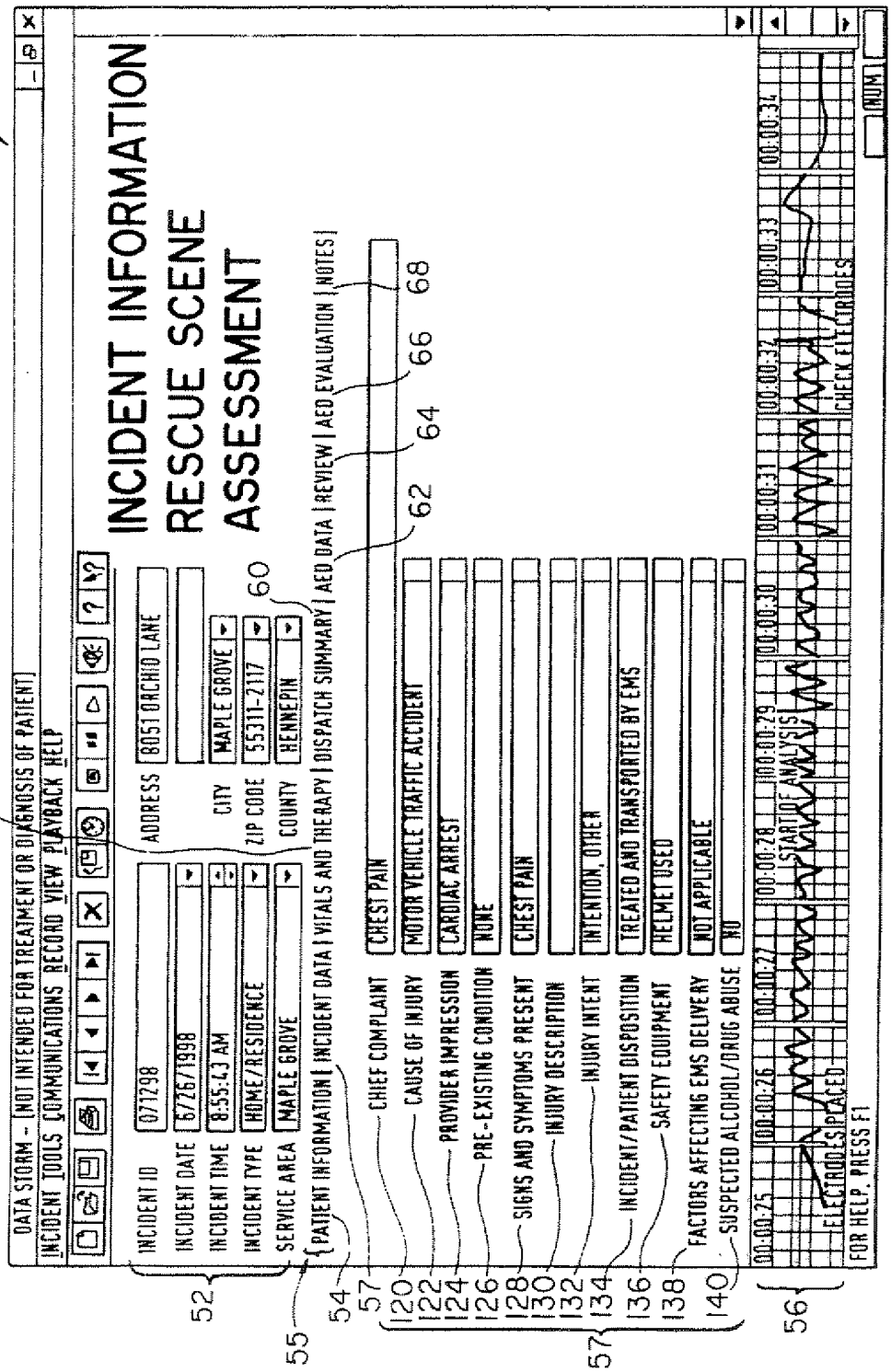

50
58
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
INCIDENT INFORMATION
RESCUE SCENE
ASSESSMENT
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
60
PATIENT INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA | REVIEW | AED EVALUATION | NOTES
CHIEF COMPLAINT
CHEST PAIN
CAUSE OF INJURY
MOTOR VEHICLE TRAFFIC ACCIDENT
PROVIDER IMPRESSION
CARDIAC ARREST
PRE-EXISTING CONDITION
NONE
SIGNS AND SYMPTOMS PRESENT
CHEST PAIN
INJURY DESCRIPTION
INJURY INTENT
INTENTION, OTHER
INCIDENT/PATIENT DISPOSITION
TREATED AND TRANSPORTED BY EMS
SAFETY EQUIPMENT
HELMET USED
FACTORS AFFECTING EMS DELIVERY
NOT APPLICABLE
SUSPECTED ALCOHOL/DRUG ABUSE
NO
62
64
66
68
START OF ANALYSIS
CHECK ELECTRODES
ELECTRODES PLACED
FOR HELP, PRESS F1
NUM
52
54
55
56
57
120
122
124
126
128
130
132
134
136
138
140

Fig. 4

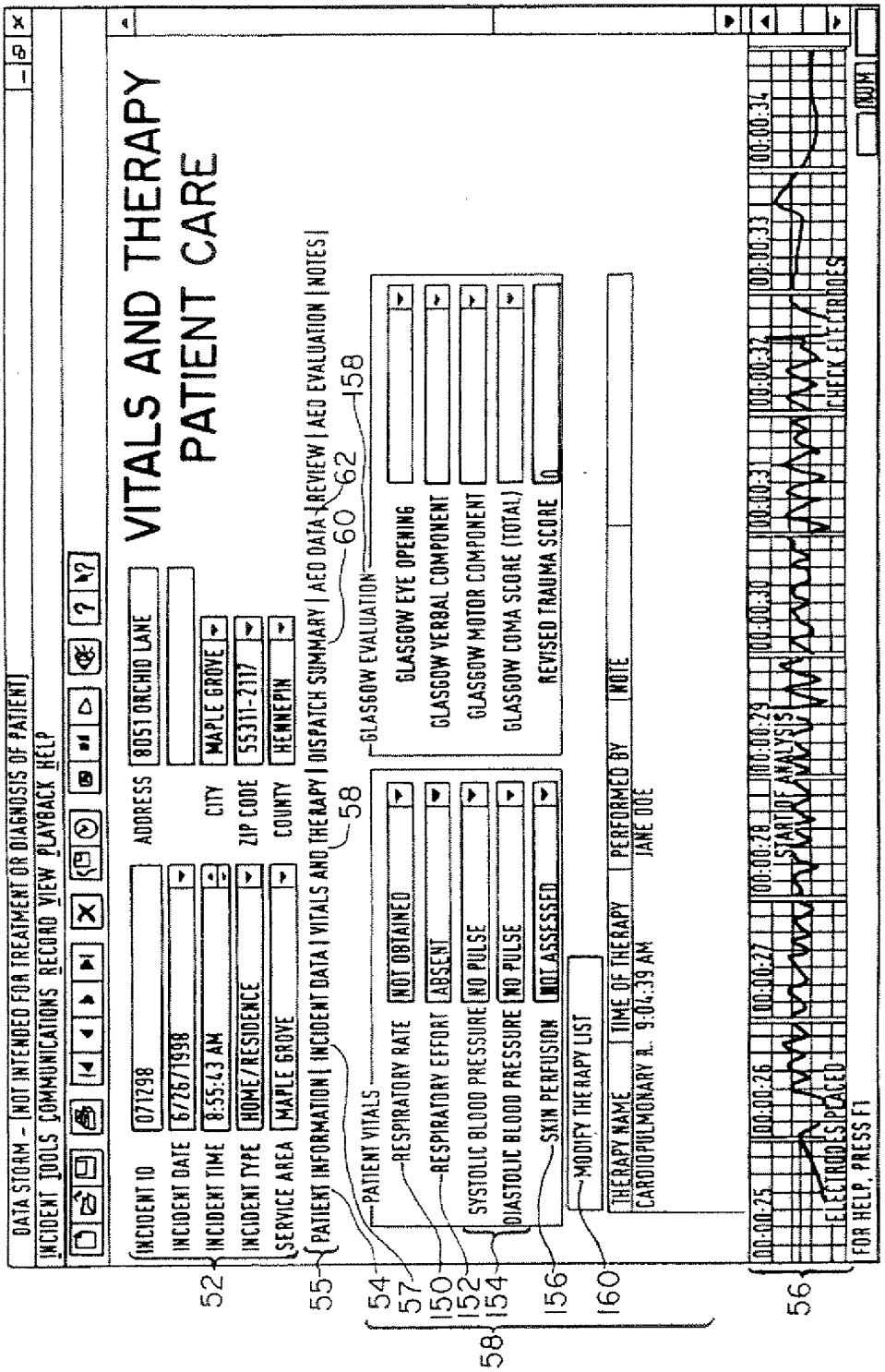
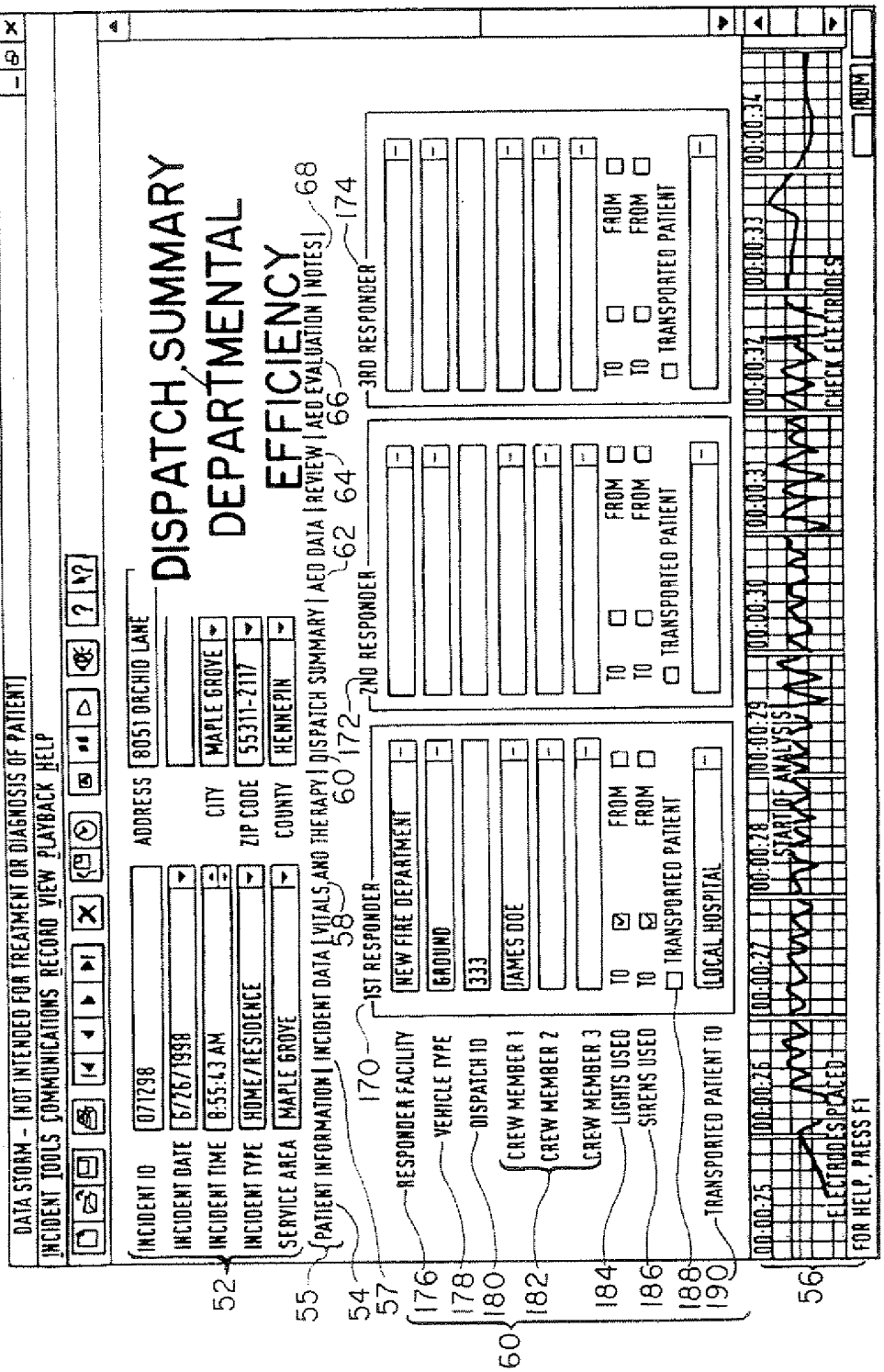

50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
VITALS AND THERAPY
PATIENT CARE
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
PATIENT INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA REVIEW | AED EVALUATION | NOTES
PATIENT VITALS
RESPIRATORY RATE NOT OBTAINED
RESPIRATORY EFFORT ABSENT
SYSTOLIC BLOOD PRESSURE NO PULSE
DIASTOLIC BLOOD PRESSURE NO PULSE
SKIN PERFUSION NOT ASSESSED
MODIFY THERAPY LIST
GLASGOW EVALUATION
GLASGOW EYE OPENING
GLASGOW VERBAL COMPONENT
GLASGOW MOTOR COMPONENT
GLASGOW COMA SCORE (TOTAL)
REVISED TRAUMA SCORE 0
THERAPY NAME | TIME OF THERAPY | PERFORMED BY | NOTE
CARDIOPULMONARY R. 9:04:39 AM JANE DOE
00:00:25 00:00:26 00:00:27 00:00:28 00:00:29 00:00:30 00:00:31 00:00:32 00:00:33 00:00:34
ELECTRODES PLACED
START OF ANALYSIS
CHECK ELECTRODES
FOR HELP, PRESS F1
NUM
52
55
54
57
150
152
154
156
160
58
56
60
62
158

Fig. 5A


50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
DISPATCH SUMMARY
DEPARTMENTAL
EFFICIENCY
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
PATIENT INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA | REVIEW | AED EVALUATION | NOTES
1ST RESPONDER
2ND RESPONDER
3RD RESPONDER
RESPONDER FACILITY
VEHICLE TYPE
DISPATCH ID
CREW MEMBER 1
CREW MEMBER 2
CREW MEMBER 3
LIGHTS USED
SIRENS USED
TRANSPORTED PATIENT TO
NEW FIRE DEPARTMENT
GROUND
333
JAMES DOE
LOCAL HOSPITAL
TO
FROM
TRANSPORTED PATIENT
CHECK ELECTRODES
FOR HELP, PRESS F1
52
54
55
56
57
58
60
62
64
66
68
170
172
174
176
178
180
182
184
186
188
190

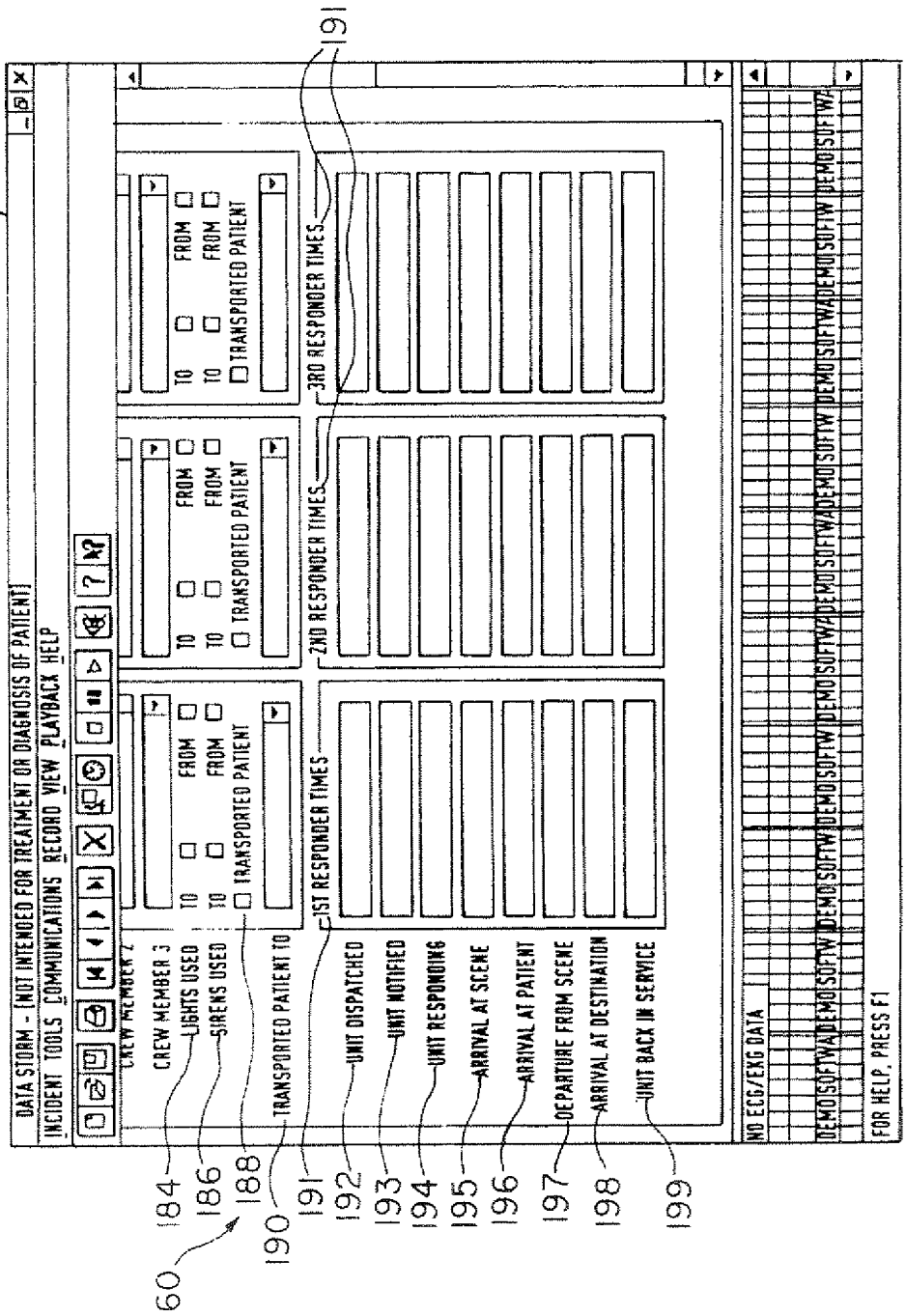

50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
CREW MEMBER 2
CREW MEMBER 3
LIGHTS USED
SIRENS USED
TRANSPORTED PATIENT
TRANSPORTED PATIENT TO
1ST RESPONDER TIMES
2ND RESPONDER TIMES
3RD RESPONDER TIMES
UNIT DISPATCHED
UNIT NOTIFIED
UNIT RESPONDING
ARRIVAL AT SCENE
ARRIVAL AT PATIENT
DEPARTURE FROM SCENE
ARRIVAL AT DESTINATION
UNIT BACK IN SERVICE
NO ECG/EKG DATA
FOR HELP, PRESS F1
60
184
186
188
190
191
192
193
194
195
196
197
198
199

Fig. 5B

Fig. 6A

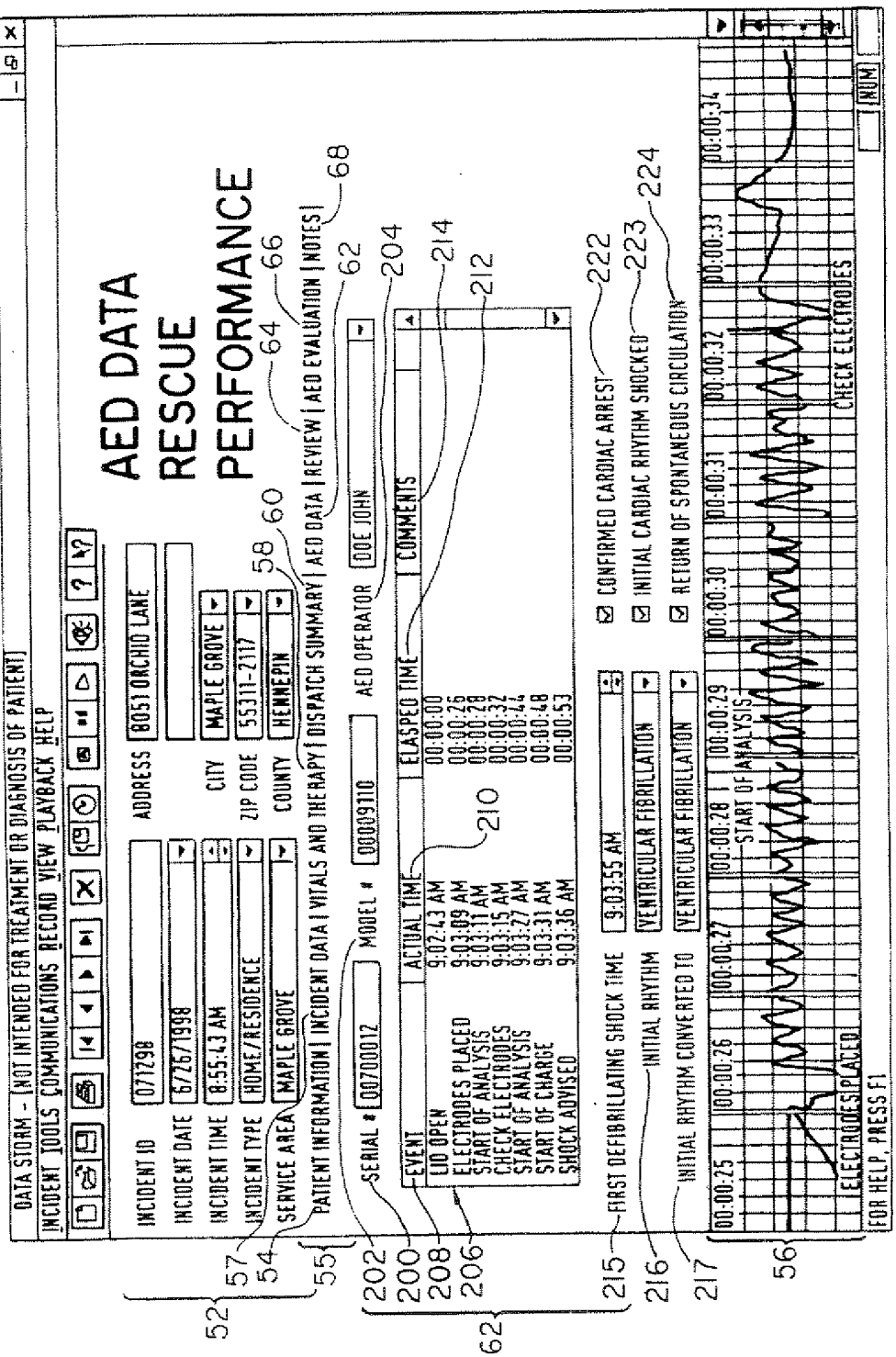

50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
AED DATA
RESCUE
PERFORMANCE
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
PATIENT INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA | REVIEW | AED EVALUATION | NOTES |
SERIAL # 00700012
MODEL # 00009310
AED OPERATOR DOE JOHN
EVENT
ACTUAL TIME
ELASPED TIME
COMMENTS
LID OPEN 9:02:43 AM 00:00:00
ELECTRODES PLACED 9:03:09 AM 00:00:26
START OF ANALYSIS 9:03:11 AM 00:00:28
CHECK ELECTRODES 9:03:15 AM 00:00:32
START OF ANALYSIS 9:03:27 AM 00:00:44
START OF CHARGE 9:03:31 AM 00:00:48
SHOCK ADVISED 9:03:36 AM 00:00:53
FIRST DEFIBRILLATING SHOCK TIME 9:03:55 AM
INITIAL RHYTHM VENTRICULAR FIBRILLATION
INITIAL RHYTHM CONVERTED TO VENTRICULAR FIBRILLATION
CONFIRMED CARDIAC ARREST
INITIAL CARDIAC RHYTHM SHOCKED
RETURN OF SPONTANEOUS CIRCULATION
00:00:25 00:00:26 00:00:27 00:00:28 00:00:29 00:00:30 00:00:31 00:00:32 00:00:33 00:00:34
START OF ANALYSIS
ELECTRODES PLACED
CHECK ELECTRODES
FOR HELP, PRESS F1
NUM
52
57
54
55
202
200
208
206
62
210
212
214
204
58
60
64
66
68
215
216
217
222
223
224
56

Fig. 6B

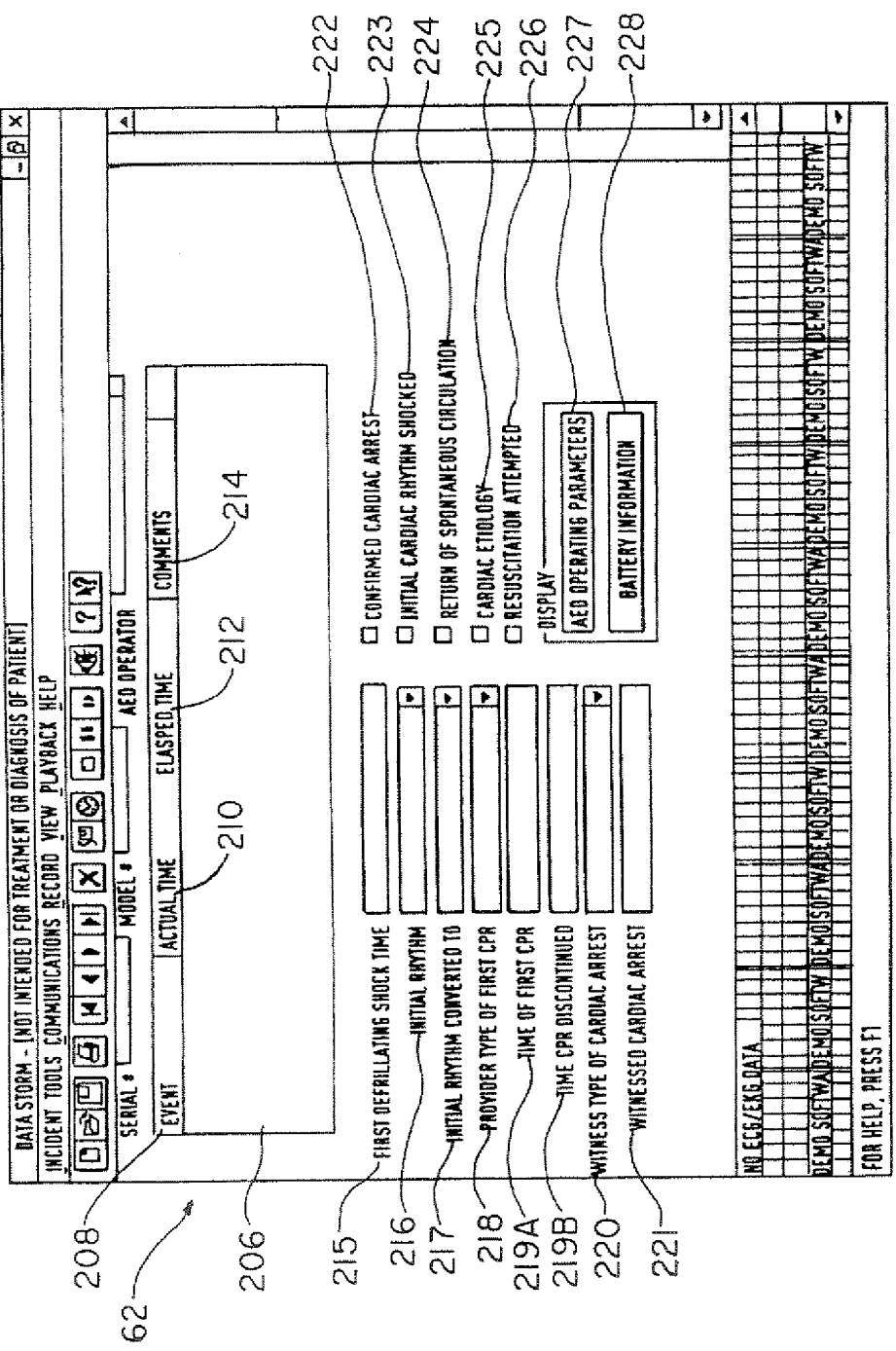

50
62
208
206
210
212
214
215
216
217
218
219A
219B
220
221
222
223
224
225
226
227
228
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
SERIAL #
MODEL #
AED OPERATOR
EVENT
ACTUAL TIME
ELASPED TIME
COMMENTS
FIRST DEFRILLATING SHOCK TIME
INITIAL RHYTHM
INITIAL RHYTHM CONVERTED TO
PROVIDER TYPE OF FIRST CPR
TIME OF FIRST CPR
TIME CPR DISCONTINUED
WITNESS TYPE OF CARDIAC ARREST
WITNESSED CARDIAC ARREST
CONFIRMED CARDIAC ARREST
INITIAL CARDIAC RHYTHM SHOCKED
RETURN OF SPONTANEOUS CIRCULATION
CARDIAC ETIOLOGY
RESUSCITATION ATTEMPTED
DISPLAY
AED OPERATING PARAMETERS
BATTERY INFORMATION
NO ECG/EKG DATA
DEMO SOFTWARE MODE SOFTW DEMO SOFTWARE MODE SOFTW DEMO SOFTWARE MODE SOFTW DEMO SOFTW DEMO SOFTWARE MODE SOFTW
FOR HELP, PRESS F1

Fig. 7A

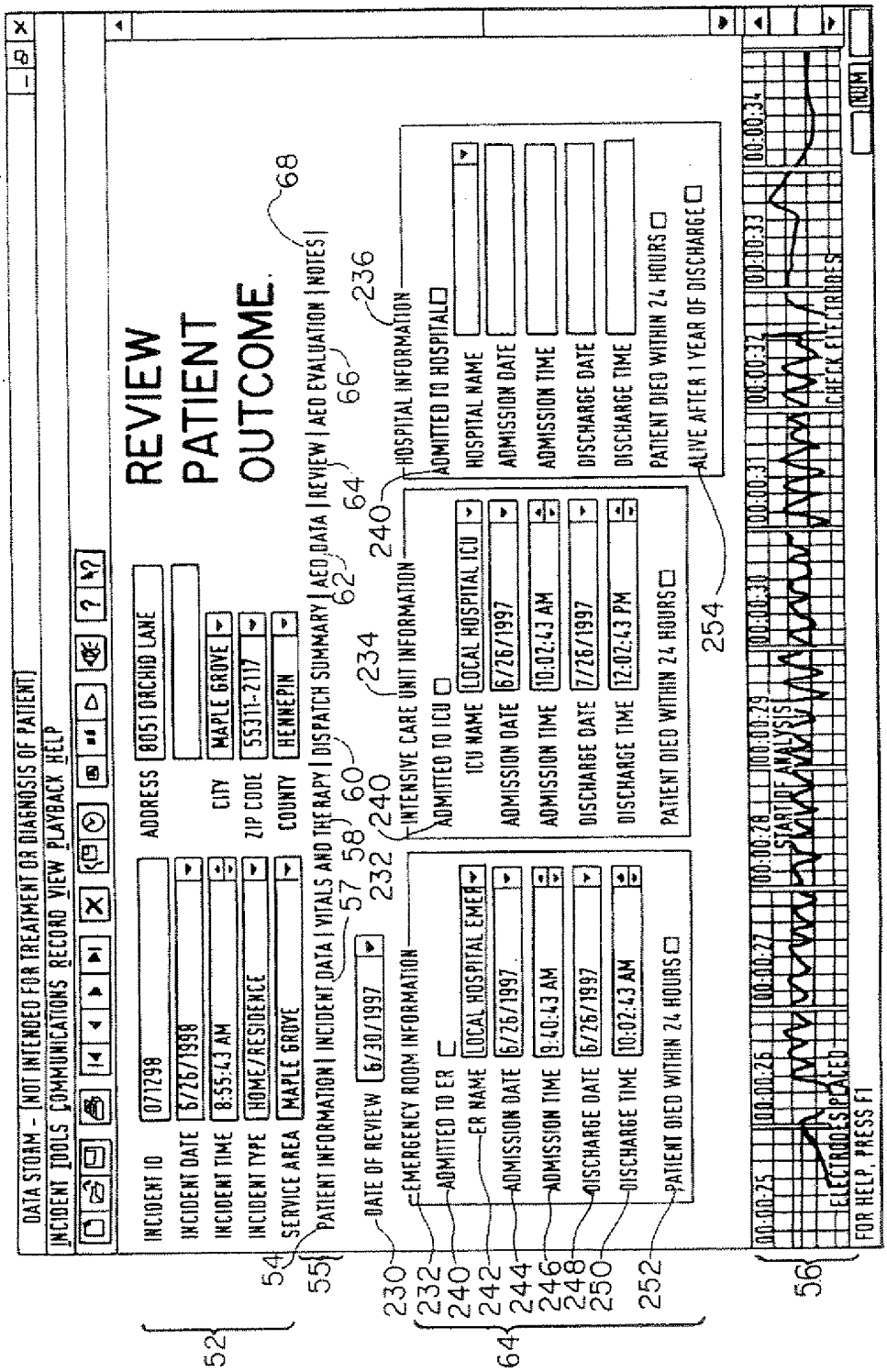

50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
REVIEW PATIENT OUTCOME
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
PATIENT INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA | REVIEW | AED EVALUATION | NOTES
DATE OF REVIEW 6/30/1997
EMERGENCY ROOM INFORMATION
ADMITTED TO ER
ER NAME LOCAL HOSPITAL EMER
ADMISSION DATE 6/26/1997
ADMISSION TIME 9:40:43 AM
DISCHARGE DATE 6/26/1997
DISCHARGE TIME 10:02:43 AM
PATIENT DIED WITHIN 24 HOURS
INTENSIVE CARE UNIT INFORMATION
ADMITTED TO ICU
ICU NAME LOCAL HOSPITAL ICU
ADMISSION DATE 6/26/1997
ADMISSION TIME 10:02:43 AM
DISCHARGE DATE 7/26/1997
DISCHARGE TIME 12:02:43 PM
PATIENT DIED WITHIN 24 HOURS
HOSPITAL INFORMATION
ADMITTED TO HOSPITAL
HOSPITAL NAME
ADMISSION DATE
ADMISSION TIME
DISCHARGE DATE
DISCHARGE TIME
PATIENT DIED WITHIN 24 HOURS
ALIVE AFTER 1 YEAR OF DISCHARGE
00:00:25 00:00:27 00:00:28 00:00:29 00:00:30 00:00:31 00:00:32 00:00:33 00:00:34
START OF ANALYSIS
ELECTRODES PLACED
CHECK ELECTRODES
FOR HELP, PRESS F1
NUM
52
54
55
56
57
58
60
62
64
66
68
230
232
234
236
240
242
244
246
248
250
252
254

Fig. 7B

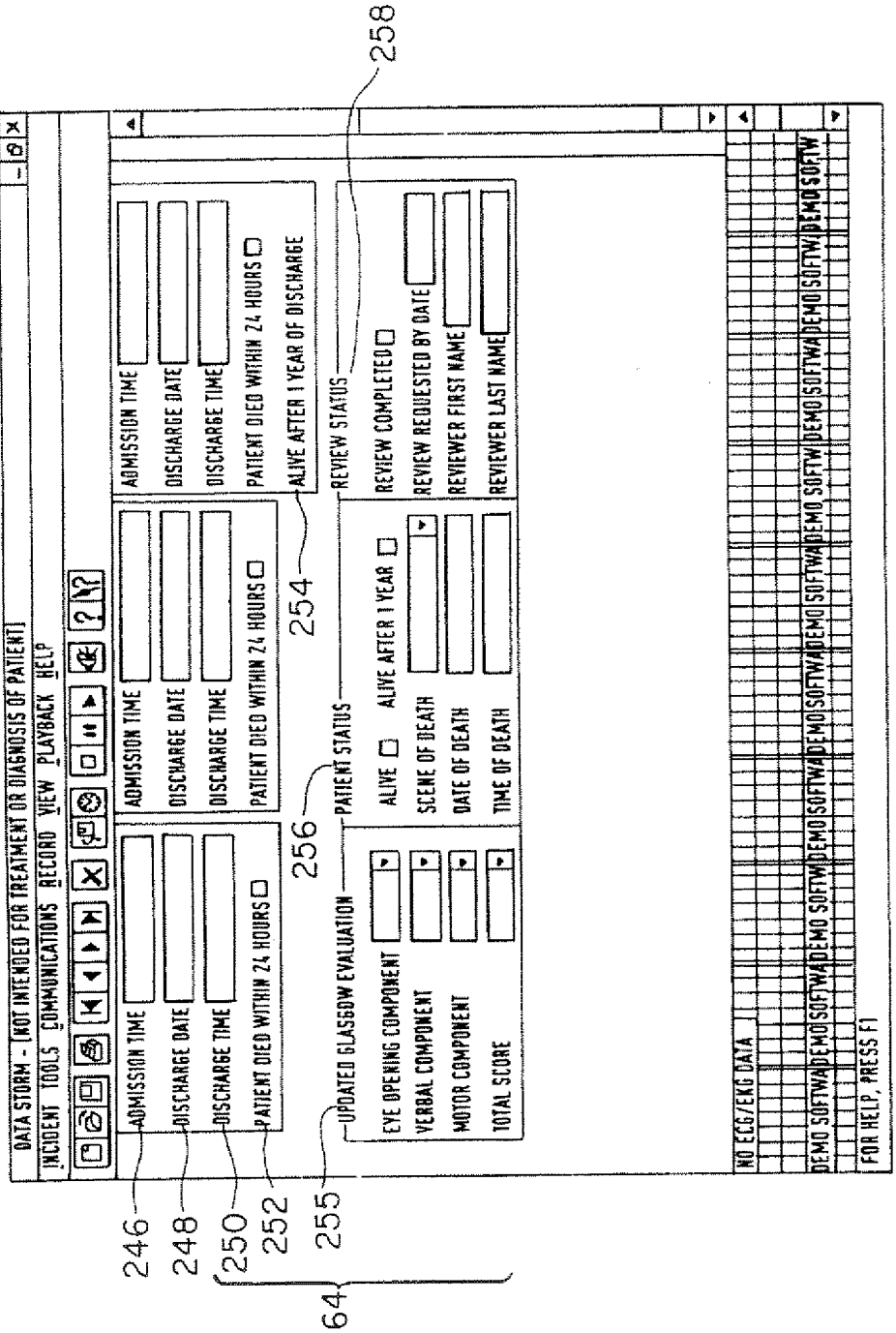

50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
ADMISSION TIME
DISCHARGE DATE
DISCHARGE TIME
PATIENT DIED WITHIN 24 HOURS
ALIVE AFTER 1 YEAR OF DISCHARGE
REVIEW STATUS
REVIEW COMPLETED
REVIEW REQUESTED BY DATE
REVIEWER FIRST NAME
REVIEWER LAST NAME
PATIENT STATUS
ALIVE
ALIVE AFTER 1 YEAR
SCENE OF DEATH
DATE OF DEATH
TIME OF DEATH
UPDATED GLASGOW EVALUATION
EYE OPENING COMPONENT
VERBAL COMPONENT
MOTOR COMPONENT
TOTAL SCORE
NO ECG/EKG DATA
DEMO SOFTWARE
FOR HELP, PRESS F1
246
248
250
252
254
255
256
258
64

Fig. 8

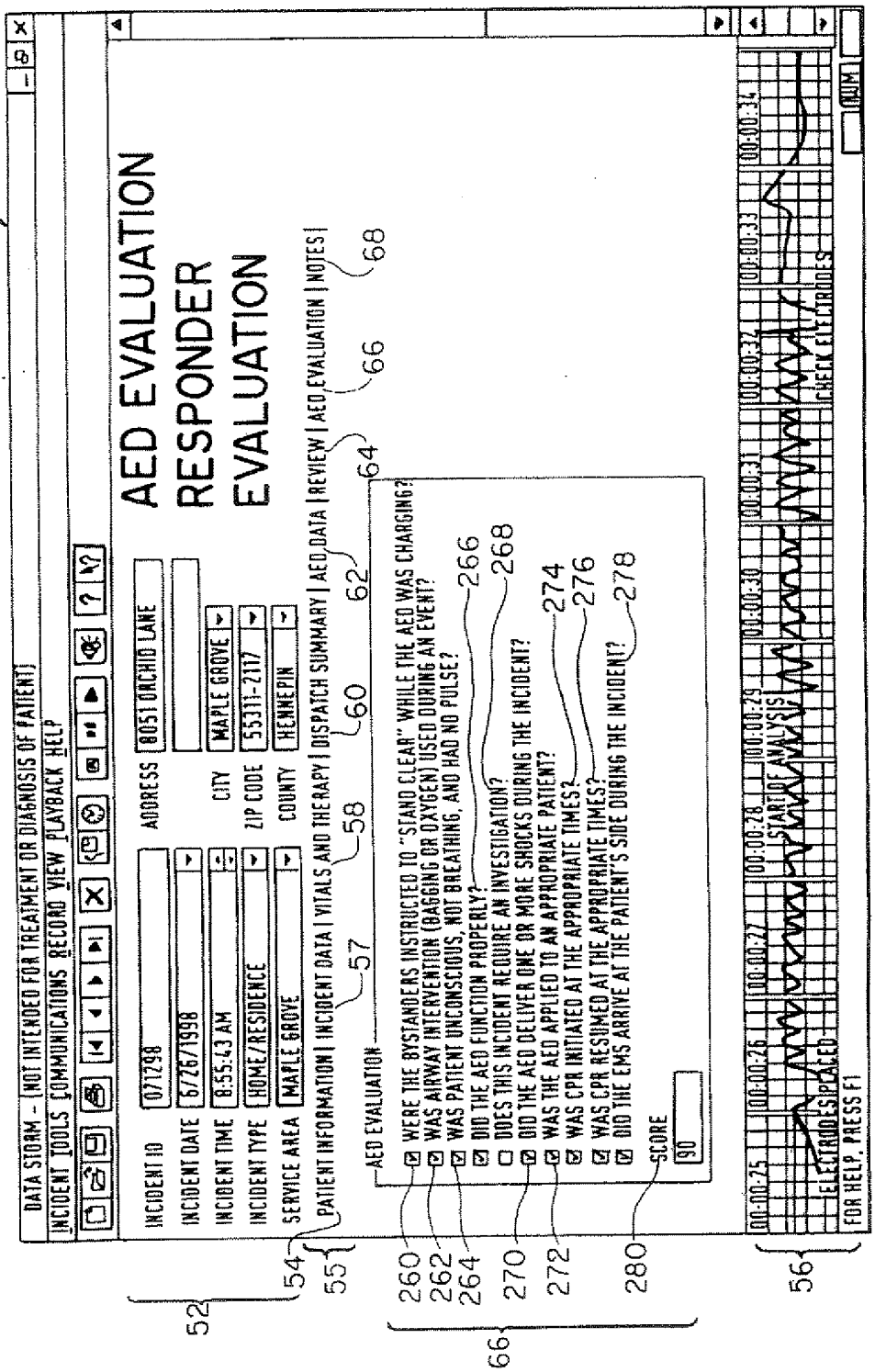
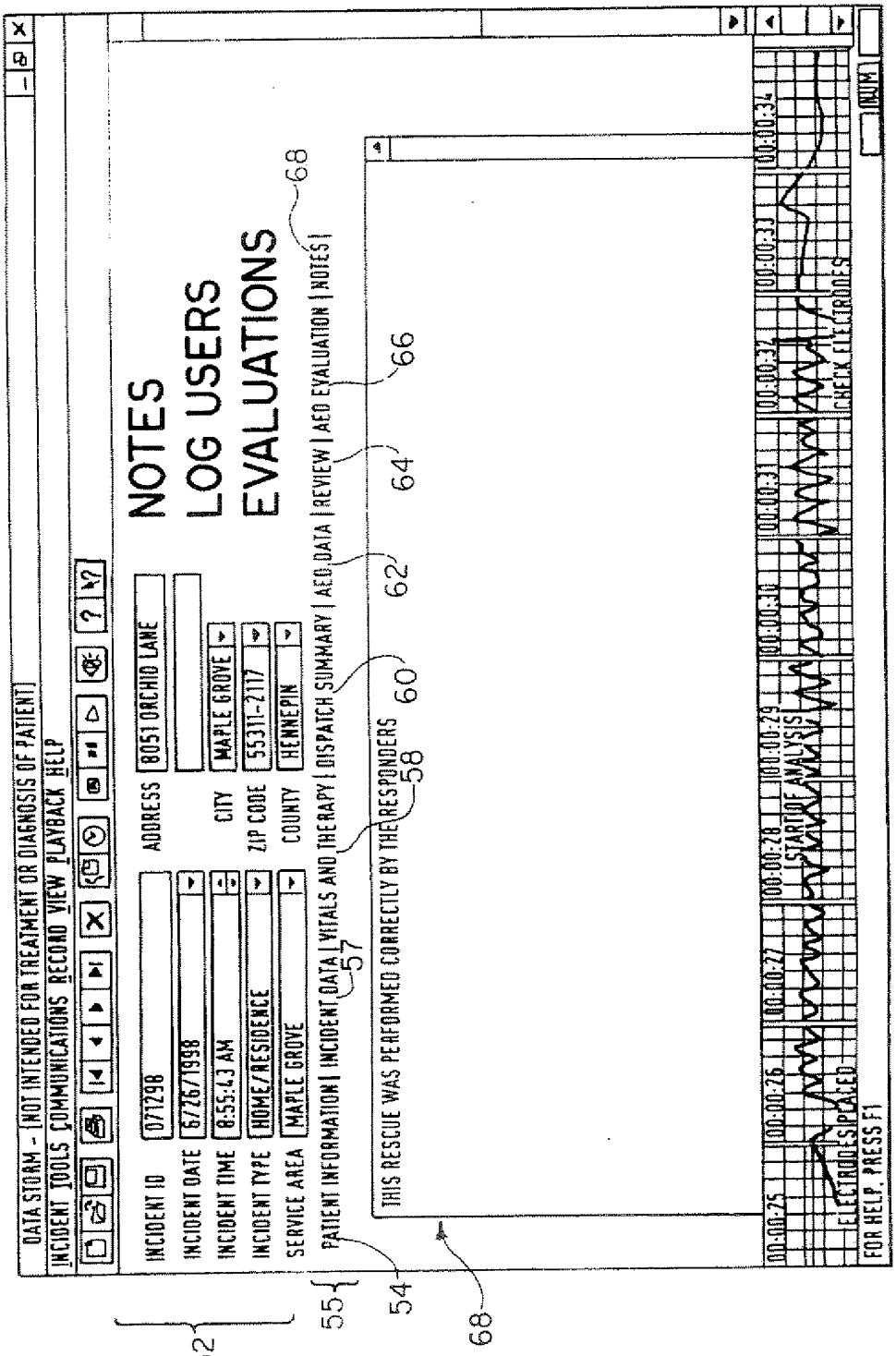

50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
AED EVALUATION
RESPONDER EVALUATION
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
PATIENT INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA | REVIEW | AED EVALUATION | NOTES
AED EVALUATION
WERE THE BYSTANDERS INSTRUCTED TO "STAND CLEAR" WHILE THE AED WAS CHARGING?
WAS AIRWAY INTERVENTION (BAGGING OR OXYGEN) USED DURING AN EVENT?
WAS PATIENT UNCONSCIOUS, NOT BREATHING, AND HAD NO PULSE?
DID THE AED FUNCTION PROPERLY?
DOES THIS INCIDENT REQUIRE AN INVESTIGATION?
DID THE AED DELIVER ONE OR MORE SHOCKS DURING THE INCIDENT?
WAS THE AED APPLIED TO AN APPROPRIATE PATIENT?
WAS CPR INITIATED AT THE APPROPRIATE TIMES?
WAS CPR RESUMED AT THE APPROPRIATE TIMES?
DID THE EMS ARRIVE AT THE PATIENT'S SIDE DURING THE INCIDENT?
SCORE
90
00:00:25
00:00:26
00:00:27
00:00:28
00:00:29
00:00:30
00:00:31
00:00:32
00:00:33
00:00:34
START OF ANALYSIS
ELECTRODES PLACED
CHECK ELECTRODES
FOR HELP, PRESS F1
NUM
52
54
55
56
57
58
60
62
64
66
68
260
262
264
266
268
270
272
274
276
278
280

Fig. 9


50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
INCIDENT ID 071298
INCIDENT DATE 6/26/1998
INCIDENT TIME 8:55:43 AM
INCIDENT TYPE HOME/RESIDENCE
SERVICE AREA MAPLE GROVE
ADDRESS 8051 ORCHID LANE
CITY MAPLE GROVE
ZIP CODE 55311-2117
COUNTY HENNEPIN
NOTES
LOG USERS
EVALUATIONS
68
PATIENT INFORMATION | INCIDENT DATA | VITALS AND THERAPY | DISPATCH SUMMARY | AED DATA | REVIEW | AED EVALUATION | NOTES |
66
64
62
60
58
57
THIS RESCUE WAS PERFORMED CORRECTLY BY THE RESPONDERS
52
55
54
68
00:00:25
00:00:26
00:00:27
00:00:28
00:00:29
00:00:30
00:00:31
00:00:32
00:00:33
00:00:34
START OF ANALYSIS
ELECTRODES PLACED
CHECK ELECTRODES
FOR HELP, PRESS F1
NUM

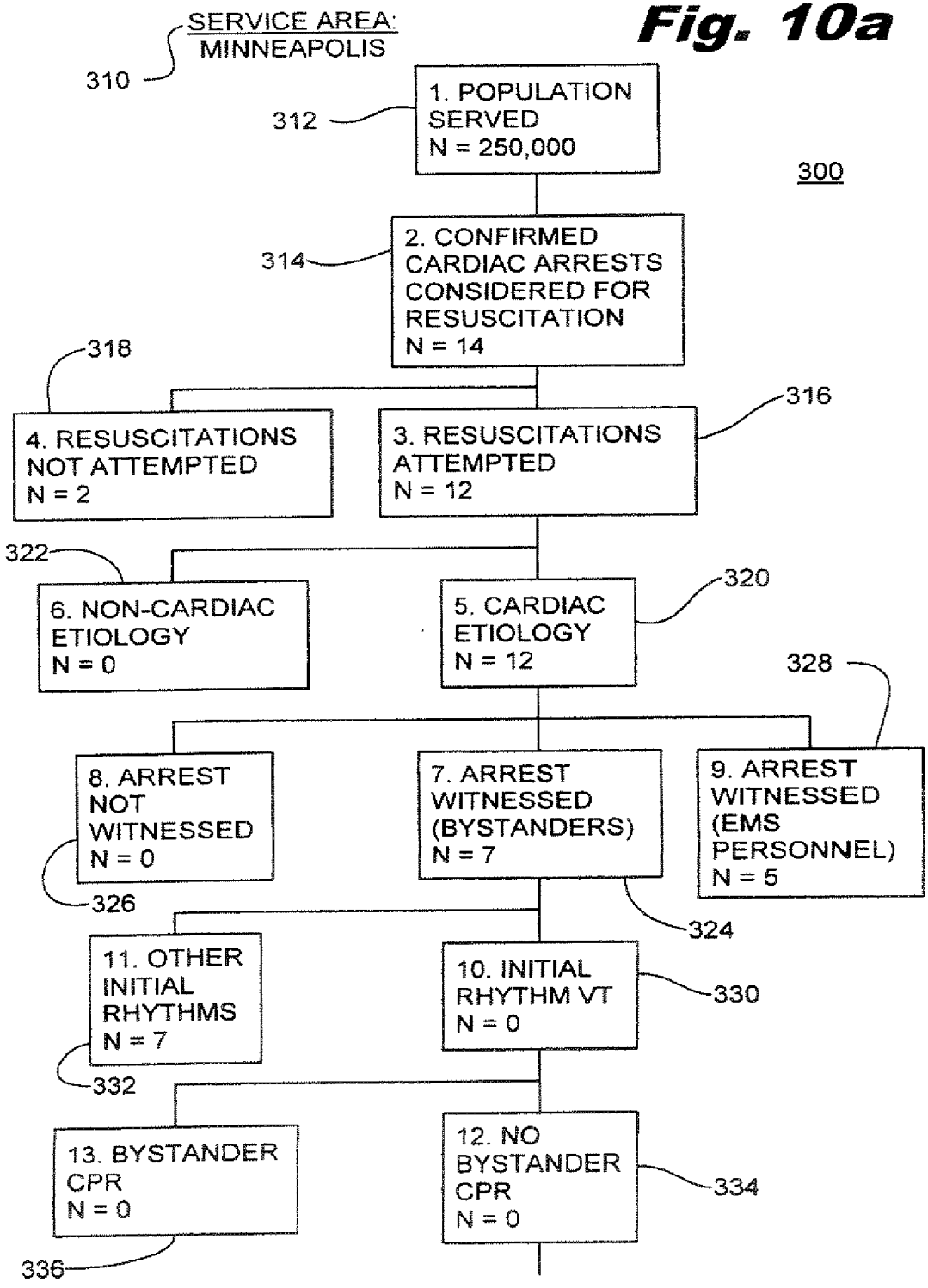

SERVICE AREA:
MINNEAPOLIS
310
1. POPULATION SERVED
N = 250,000
312
300
2. CONFIRMED CARDIAC ARRESTS CONSIDERED FOR RESUSCITATION
N = 14
314
318
316
4. RESUSCITATIONS NOT ATTEMPTED
N = 2
3. RESUSCITATIONS ATTEMPTED
N = 12
322
320
6. NON-CARDIAC ETIOLOGY
N = 0
5. CARDIAC ETIOLOGY
N = 12
328
8. ARREST NOT WITNESSED
N = 0
7. ARREST WITNESSED (BYSTANDERS)
N = 7
9. ARREST WITNESSED (EMS PERSONNEL)
N = 5
326
324
11. OTHER INITIAL RHYTHMS
N = 7
10. INITIAL RHYTHM VT
N = 0
330
332
13. BYSTANDER CPR
N = 0
12. NO BYSTANDER CPR
N = 0
334
336

Fig. 10a

Fig. 10b

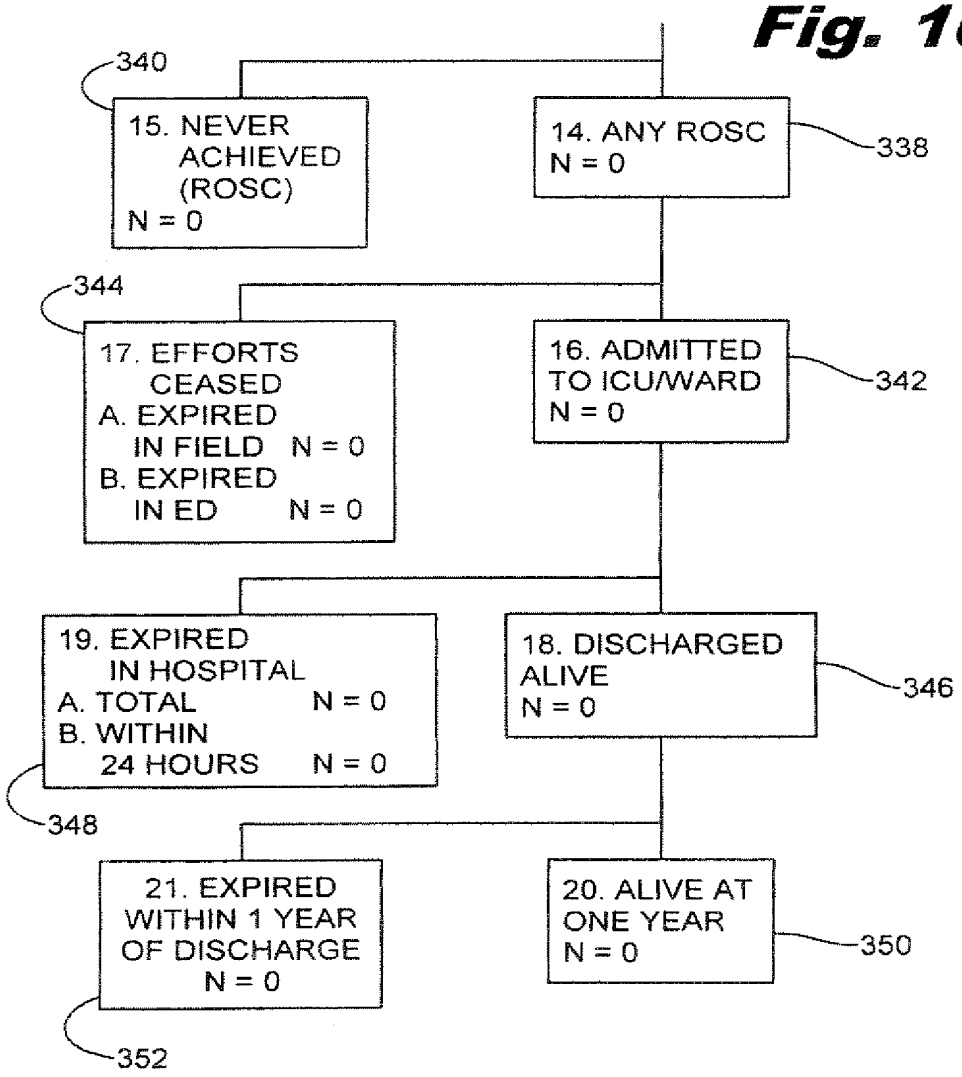

340
15. NEVER ACHIEVED (ROSC) N = 0
14. ANY ROSC N = 0
338
344
17. EFFORTS CEASED
A. EXPIRED IN FIELD N = 0
B. EXPIRED IN ED N = 0
16. ADMITTED TO ICU/WARD N = 0
342
19. EXPIRED IN HOSPITAL
A. TOTAL N = 0
B. WITHIN 24 HOURS N = 0
18. DISCHARGED ALIVE N = 0
346
348
21. EXPIRED WITHIN 1 YEAR OF DISCHARGE N = 0
20. ALIVE AT ONE YEAR N = 0
350
352

Fig. 11

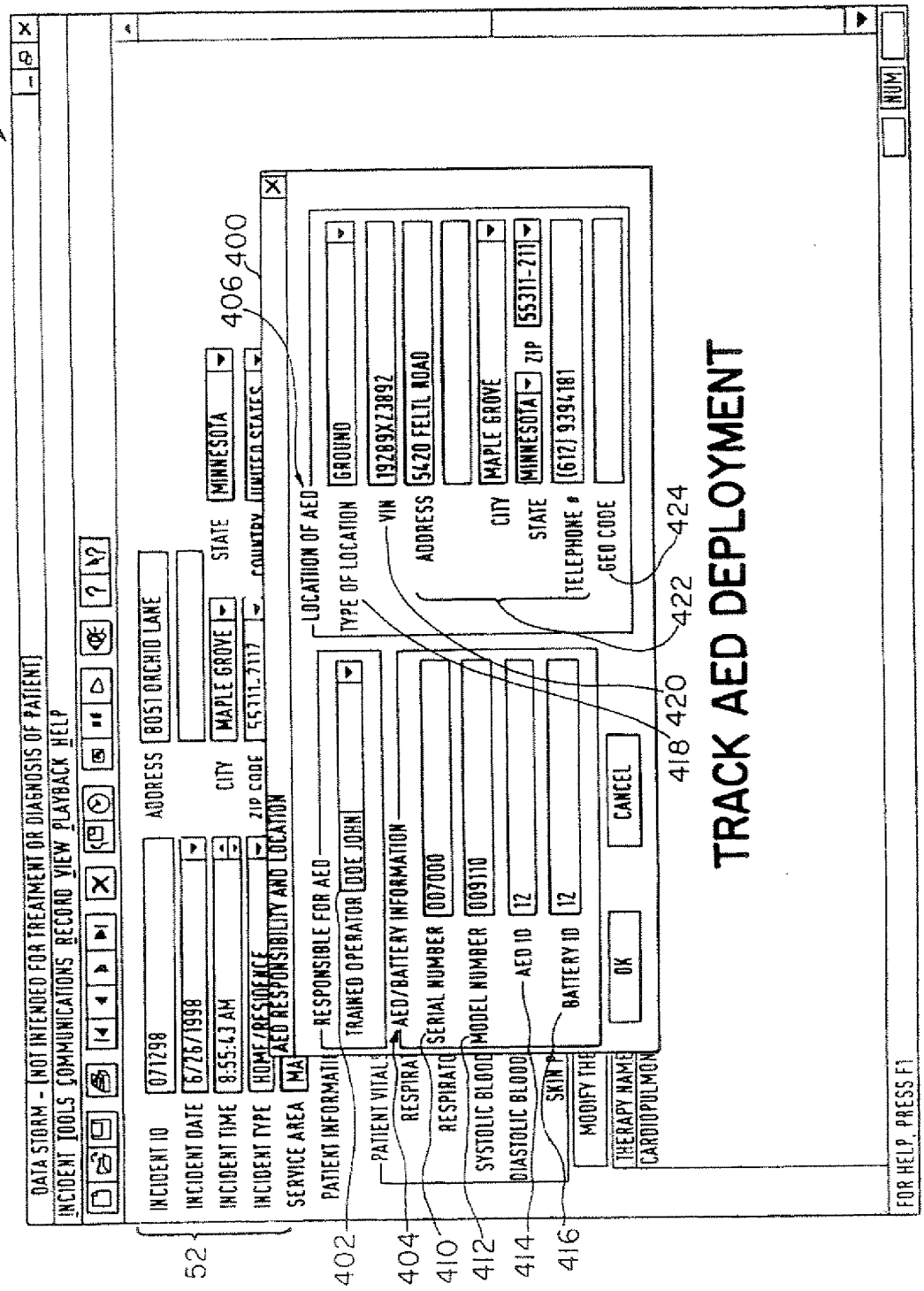
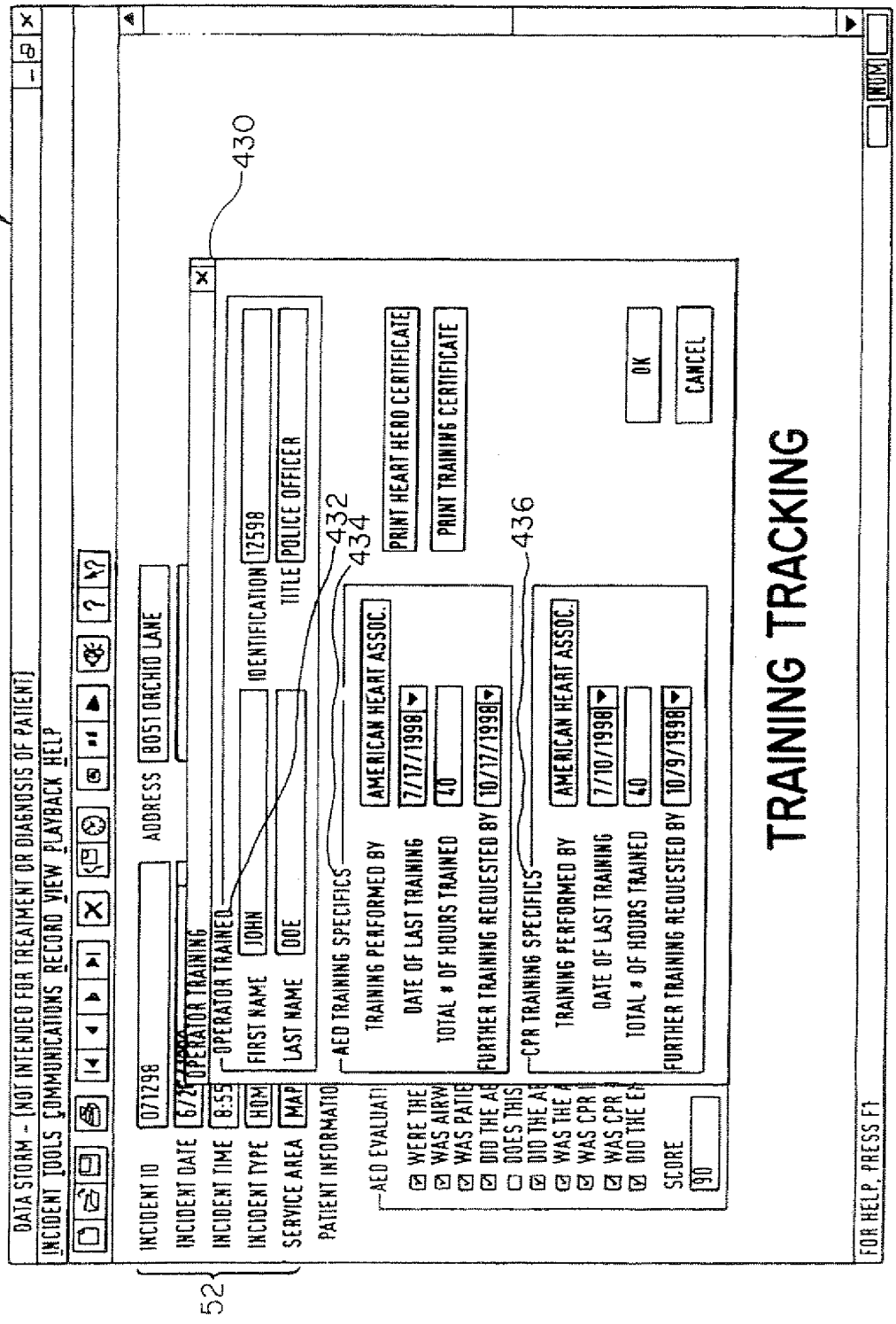

50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
INCIDENT ID
INCIDENT DATE
INCIDENT TIME
INCIDENT TYPE
SERVICE AREA
ADDRESS
CITY
ZIP CODE
STATE
COUNTRY
8051 ORCHID LANE
MAPLE GROVE
MINNESOTA
UNITED STATES
406
400
LOCATION OF AED
TYPE OF LOCATION
GROUND
VIN
19289X23892
ADDRESS
5420 FELTL ROAD
CITY
MAPLE GROVE
STATE
MINNESOTA
ZIP
55311-2111
TELEPHONE #
(612) 9394181
GEO CODE
424
422
420
418
RESPONSIBLE FOR AED
TRAINED OPERATOR
DOE JOHN
AED/BATTERY INFORMATION
SERIAL NUMBER
007000
MODEL NUMBER
009110
AED ID
12
BATTERY ID
12
OK
CANCEL
TRACK AED DEPLOYMENT
FOR HELP, PRESS F1
NUM
52
402
404
410
412
414
416

Fig. 12


50
DATA STORM - [NOT INTENDED FOR TREATMENT OR DIAGNOSIS OF PATIENT]
INCIDENT TOOLS COMMUNICATIONS RECORD VIEW PLAYBACK HELP
INCIDENT ID
071298
INCIDENT DATE
INCIDENT TIME
8:55
INCIDENT TYPE
HOM
SERVICE AREA
MAP
PATIENT INFORMATIO
ADDRESS
8051 ORCHID LANE
OPERATOR TRAINING
OPERATOR TRAINED
FIRST NAME
JOHN
LAST NAME
DOE
IDENTIFICATION
12598
TITLE
POLICE OFFICER
AED TRAINING SPECIFICS
TRAINING PERFORMED BY
AMERICAN HEART ASSOC.
DATE OF LAST TRAINING
7/17/1998
TOTAL # OF HOURS TRAINED
4.0
FURTHER TRAINING REQUESTED BY
10/17/1998
PRINT HEART HERO CERTIFICATE
PRINT TRAINING CERTIFICATE
CPR TRAINING SPECIFICS
TRAINING PERFORMED BY
AMERICAN HEART ASSOC.
DATE OF LAST TRAINING
7/10/1998
TOTAL # OF HOURS TRAINED
4.0
FURTHER TRAINING REQUESTED BY
10/9/1998
SCORE
90
OK
CANCEL
TRAINING TRACKING
AED EVALUATI
WERE THE
WAS AIRW
WAS PATIE
DID THE AE
DOES THIS
DID THE AE
WAS THE A
WAS CPR
WAS CPR
DID THE EF
FOR HELP, PRESS F1
NUM
52
430
432
434
436

AUTOMATIC EXTERNAL DEFIBRILLATOR FIRST RESPONDER AND CLINICAL DATA OUTCOME MANAGEMENT SYSTEM

RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 60/080,130, filed Mar. 31, 1998, incorporated herein in its entirety by reference.

FIELD OF THE INVENTION

The present invention relates to medical emergency event management and, in particular, relates to a computer-based communications network and database for management of emergency medical events such as sudden cardiac arrest rescue events.

BACKGROUND OF THE INVENTION

Cardiac arrest, exposure to high-voltage power lines, and other trauma to the body can result in ventricular fibrillation which is the rapid and uncoordinated contraction of the myocardium. The use of external defibrillators to restore the heartbeat to its normal pace through the application of electrical shock is a well-recognized and important tool in resuscitating patients. External defibrillation is used in emergency settings in which the patient is either unconscious or otherwise unable to communicate.

Automated external defibrillators (AEDs) are used by first responders such as police officers, paramedics, and other emergency medical technicians to resuscitate cardiac arrest patients. The AED must be used quickly and properly by the first responder, since the chance of successfully resuscitating the patient decreases approximately 10 percent-per-minute following cardiac arrest.

With the advent of emerging technologies such as AEDs, emergency medical systems (EMS) have greater opportunities for saving lives. However, because of increasing health care costs, an elevated standard of care, and competitiveness in the health care provider market, EMS directors must improve their management of cardiac rescue events with AEDs.

Unfortunately, current attempts at managing performance of sudden cardiac arrest rescues suffer from a lack of coordination and cohesiveness that is necessary to accurately and comprehensively track and evaluate out-of-hospital cardiac arrest rescues. For example, data regarding a cardiac rescue attempt typically arrives to the EMS director from several sources, occurring at different points in time, and commonly in different formats which must be integrated away from the cardiac rescue site. Moreover, current techniques of reviewing cardiac rescue events lack the appropriate data to make significant strides in improving the quality of out-of-hospital cardiac arrests. Finally, conventional computer-based tools for integrating and reviewing cardiac rescue data inflexibly require separate review and analysis of the incident, the AED and AED operator performance, and the ECG.

SUMMARY OF THE INVENTION

A method and system of the present invention manages cardiac rescue events. Unlike prior systems, this method and system uses a rescue scene computer to obtain patient and incident data at the rescue scene and then marry that data with ECG rescue data and automated external defibrillator (AED) rescue data. All of these data are then simultaneously transmitted to a base computer at an emergency medical center for review. Accordingly, a reviewer at the base computer can immediately review the ECG and AED performance in context with patient and incident data.

The method and system includes a Windows®-based single screen graphical user interface for entering and reviewing the data, and particularly includes a window for viewing ECG data simultaneously with entry and review of all other data available in the single screen user interface.

In addition, as data (e.g., ECG, patient, incident, AED, etc.) are placed in the system, these data are instantly registered by the system with corresponding NHSTA codes. This feature automatically readies the cardiac rescue data for reporting to national authorities. In addition, the NHSTA codes are embedded in the background of the active data fields to permit selective activation, deactivation, modification, and/or initialization. Moreover, appropriate data fields are supplied to insure all data for UTSTEIN-style reporting is obtained to permit UTSTEIN-style reporting of out-of-hospital cardiac arrest.

Finally, the system and method uses open database connectivity (ODBC) to permit any desired data from a cardiac rescue event that are logged into other types of systems and methods to be imported into the method and system of the present invention. Similarly, data from the system and method of the present invention can be exported to other ODBC-compatible data management systems and methods for further review, revision, or publication.

The system and method comprises one or more of the following elements including a base computer, a portable rescue scene computer, an automated external defibrillator (AED), and a communication link for linking the rescue scene computer to the base computer and/or the AED. The system and method further includes software that is programmed in the base computer and rescue scene computer to operate the single screen user interface and database.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic illustration of a cardiac rescue event data management system and method of the present invention.

FIG. 2A is a schematic representation of a rescue scene location screen and patient information tab window, with optional simultaneous ECG display, of a graphical user interface of the system and method of the present invention.

FIG. 2B is a schematic representation of a drop-down table for an incident type data field of the rescue scene location view screen of FIG. 2A.

FIG. 2C is a schematic representation of an edit window for the drop-down table of FIG. 2B showing a NHSTA code corresponding to the incident type data field entry.

FIG. 3 is a schematic representation of an incident information tab window, with optional simultaneous ECG display, of a graphical user interface of the system and method of the present invention.

FIG. 4 is a schematic representation of a patient vitals and therapy information tab window, with optional simultaneous ECG display, of a graphical user interface of the system and method of the present invention.

FIGS. 5A–5B are schematic representations of a rescue dispatch information tab window, with optional simultaneous ECG display, of a graphical user interface of the system and method of the present invention.

FIGS. 6A–6B are schematic representations of an automated external defibrillator and operator performance tab window, with optional simultaneous ECG display, of a

graphical user interface of the system and method of the present invention.

FIGS. 7A–7B are schematic representations of a patient outcome tab window, with optional simultaneous ECG display, of a graphical user interface of the system and method of the present invention.

FIG. **8** is a schematic representation of an AED and AED operator review tab window, with optional simultaneous ECG display, of a graphical user interface of the system and method of the present invention.

FIG. **9** is a schematic representation of a reviewer note tab window, with optional simultaneous ECG display, of a graphical user interface of the system and method of the present invention.

FIG. **10** is a schematic representation of a report of the system and method of the present invention for reporting UTSTEIN data on cardiac arrest incidents.

FIG. **11** is a schematic representation of an AED deployment tool window of the method and system of the present invention.

FIG. **12** is a schematic representation of an AED training tool window of the method and system of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A method and system for managing cardiac rescues of the present invention is schematically shown in FIG. **1** at **20**. System **20** includes AED **22**, AED data card **24**, and rescue scene computer **26**, all locatable at cardiac rescue scene **28**. System **20** further includes land line communication link **30** or wireless link **32** and base computer **34** at database management or emergency medical center **36**.

Both rescue scene computer **26** and base computer **34** further include display **38** with graphical user interface **40** (i.e., view screen) and input means **42** such as a keyboard for entering data into the view screen of the user interface. AED **22** further includes a cable **43** for communicating with rescue scene computer **26**.

AED **22** preferably includes an AED such as the one disclosed in Olson, et. al, U.S. Pat. No. 5,645,571, titled AUTOMATED EXTERNAL DEFIBRILLATOR WITH LID ACTIVATED SELF-TEST SYSTEM, which is hereby incorporated by reference in its entirety. AED **22** is capable of recording an ECG on a patient, and advising and delivering an electrical shock as necessary. The AED also makes an audio recording at the cardiac rescue scene of an operator's or bystander's voice during the ECG. Data from the cardiac rescue event, including the ECG recorded in real time, data from AED-detectable events (e.g., check electrodes, place electrodes, rhythm analyzed, shock advised, shock delivered, etc.), and the audio recording are recorded internally within AED **22** for later downloading to a computer for further analysis. The data can also be stored onto a data storage card that is removably insertable into AED **22**, such as AED memory data card **24**. AED memory data card **24** is, in turn, removably insertable into rescue scene computer **26**, or into base computer **34**, for transferring the ECG and AED performance data from AED **22** into the respective rescue scene computer **26** or base computer **34**. Alternatively, the data can be downloaded from AED **22** into rescue scene computer **26** via cable **43**.

Rescue scene computer **26** and base computer **34** are both general purpose personal computers well known in the art. For example, both rescue scene computer **26** and base computer **34** include, at a minimum, a CPU such as a 486SX-66 MHz (or faster) processor. Rescue scene computer **26** and base computer **34** also include sufficient RAM memory (e.g., 16 megabytes) and hard drive memory (e.g., 80 megabytes) to store and operate Microsoft® Windows 95 or NT and the database software (e.g., Microsoft® Access) supporting the system and method of the present invention. Rescue scene computer **26** includes any portable computer such as a laptop personal computer (PC) or a handheld PC.

During a cardiac rescue event, a first responder or other operator uses AED **22** to defibrillate a cardiac arrest patient. Data representing the ECG and the AED/AED operator performance are recorded internally within AED **22** and then transferred onto AED data card **24**. Next, this ECG/AED data are transferred into rescue scene computer **26** via cable **43**, or by removal of AED data card **24** from AED **22**, and into rescue scene computer **26**. In addition, while at the rescue scene, the first responder or other technician manually enters patient and incident data regarding the cardiac rescue event into rescue scene computer **26**. With all of the ECG data, AED data, and non-ECG data (e.g., patient and incident information) loaded into rescue scene computer **26**, this entire set of data is transmitted via landline link **30** or wireless link **32** to base computer **34** at a central emergency medical system center **36**.

The ECG data, AED data, and non-ECG data are then observable together in an integrated fashion on base computer **34** in single screen graphical user interface **40**. All of this data can be reviewed or modified as necessary, while additional information regarding the cardiac rescue event, including post event care and related emergency medical system performance, can be entered by the user through the single screen user interface **40** using input means **42**. Using this technique, data are comprehensively and accurately captured to permit meaningful and rapid evaluation of each cardiac rescue event. Over time, as the system and method of the present invention is applied across localities, states, and nationally, for multiple cardiac rescue events, a tremendous database will be developed. This information will greatly contribute to improving rescue techniques and understanding the delivery and effectiveness of emergency medical intervention.

The remaining description explains single screen user interface **40** in greater detail, including how and where the ECG data, AED data, and non-ECG data are displayed as well as how other cardiac rescue event performance, evaluation, and reporting information is handled.

FIG. **2** is a schematic representation of single screen graphical user interface **40** permitting entry, review, and revision of data regarding a cardiac rescue event. Interface **40** defines single view screen **50** having resident components, such as rescue scene location **52**, and selective viewing components, such as patient information tab window **54**, and optional ECG window **56**. Tabs **55** mark access to selectable patient information tab window **54** as well as other selectable tab windows such as incident data window **57**, vitals and therapy window **58**, dispatch summary window **60**, AED data window **62**, review window **64**, AED evaluation window **66**, and notes window **68**. Once a tab is selected, the window corresponding to that tab is displayed in an overlay fashion over the other tab windows. Data is entered via input means **42** into the data fields visible in the selected window, which correspond directly with data fields of the database that operates in the background (not visible). Data fields within the tab windows include stored data in drop-down windows that can be selected and/or are capable of receiving manually entered new data.

At the rescue scene, an operator fills in the data fields of rescue scene location screen **52** using input means **42** of rescue scene computer **26** to collect general information about the patient and the incident. As shown in FIG. **2**, rescue scene location screen **52** includes the following data fields: incident ID **80**, incident date **82**, incident time **84**, incident type **86**, service area **88**, rescue address **90** (street, city, state, zip code, country, county), and geographic code **92**. Rescue scene location screen **52** always remains active in single screen user interface **40**. Patient information tab window **54** includes the following data fields: patient name **100**, patient description **102** (such as date of birth, age, gender, race), patient address **104** (street, city, state, zip code, county), and patient telephone **106**.

FIG. **2** also shows ECG pull-up window **56** which graphically displays a real time representation of the ECG recorded during the cardiac rescue event with AED **22**. ECG pull-up window **56** includes the following data fields: real time stamp **110**, ECG waveform **112**, and AED event stamp **114** (e.g., electrodes placed, start of analysis, check electrodes). ECG window **56** defines a splitter window **115** that can be reduced or enlarged vertically on single screen user interface **40**. ECG window **56** also can be deactivated for selective removal from single screen user interface **40**. All of the textual and graphically represented data in the ECG window **56** is obtained from AED **22**.

When deployed in a handheld PC embodiment, rescue scene computer **26** operates a simpler graphical user interface like single screen user interface **40** that includes at least the corresponding data fields from patient information tab window **54** and incident information tab window **57** (described below).

The database supporting single screen graphical user interface **40** was constructed using Windows® operating system and Access® database system, both sold by Microsoft Corporation. Accordingly, the multiple tab window structure within the single screen user interface **40**, as well as the optional simultaneous ECG window **56**, can be constructed by one skilled in the art using the tools and capabilities of Access® database program and Windows® operating system. In particular, the data access object (DAO) mode of the Access® program can be used to identify the desired data fields and relationship tables of the database, as well as the NHSTA codes further described below. The system and method of the present invention also includes an embedded registry of certain National Highway Safety Traffic Administration (NHSTA) codes that is linked to corresponding cardiac/accident rescue data fields. The NHSTA codes used in the method and system of the present invention are published in Federal Information Standard (FIPS) Publication **28**, and in International Classification of Disease and Related Health Problems Ninth Revision (ICD-9) and the Tenth Revision (ICD-10). The database is built in the open database connectivity format (ODBC) to permit data to be imported and exported entirely, or selectively, using an ODBC data management program such as Access®, FoxPro®, or SQL®, all known to those skilled in the art. For example, a common ODBC program can be used to extract all or some of the NHSTA-related data from the system. To do so, the user identifies the tables and data fields carrying an embedded NHSTA code (or other desired category of information) and marks them for extraction. Once all of the NHSTA-related data are exported, it can be further manipulated by the ODBC program into a format suitable for reporting to national, state or local authorities. Similarly, data can be extracted for other reporting purposes such as UTSTEIN-style reporting to national, state or local authorities, or for billing purposes with additional modification of the database of the method and the system of the present invention.

The corresponding NHSTA codes for a given data field can be modified, added, or deleted by operating an edit list for the data field and then entering or editing the NHSTA code designation corresponding to that data field. For example, as shown in FIG. **2B**, drop-down table **87A** for the data field incident type **86** of rescue scene location **52** is selected, displaying several choices to fill this data field as well as "edit list" function **87B**. By selecting the "edit list" function, another edit window, shown in FIG. **2C**, is ultimately displayed on single screen user interface **40**, which displays the data field, its entry, and the corresponding NHSTA code **87E** for that entry. The default NHSTA code is displayed, if available, which can be modified, deleted, or added as necessary.

FIG. **3** shows single screen user interface **40** with incident data tab window **57** selected and optional ECG window **56** activated. Like patient tab window **54**, incident tab window **57** is used at the cardiac rescue scene to prompt the user to collect information about the incident, which will be transmitted to base computer **34** with patient data, ECG data, and AED data. Incident data tab window **56** includes the following data fields: chief complaint **120**, cause of injury **122**, provider impression **124**, pre-existing condition **126**, signs and symptoms present **128**, injury description **130**, injury intent **132**, incident/patient disposition **134**, safety equipment **136**, factors affecting EMS delivery **138**, suspected alcohol/drug abuse **140**.

FIG. **4** shows single screen user interface **40** with vitals and therapy tab window **58**. The patient vitals and therapy data are typically collected at the cardiac rescue scene with the other patient data (tab window **54**) and included for transmission with the ECG data to base computer **34**. Once the vitals and therapy tab is selected, window **58** displays and includes the following data fields: respiratory rate **150**, respiratory effort **152**, blood pressure **154**, skin perfusion **156**, with Glasgow evaluation **158** (including eye opening, verbal component, motor component, coma score, and revised trauma score), modified therapy list **160** (including therapy name, therapy time, therapy performer, and notes).

FIG. **5A** shows single screen user interface **40** with dispatch summary tab window **60** selected, and which includes the following data fields for first responder **170**, second responder **172**, and third responder **174**: responder facility **176**, vehicle type **178**, dispatch ID **180**, crew members **182**, lights used **184**, sirens used **186**, transported patient **188**, and location to which patient was transported **190**. As shown in FIG. **5B**, a lower portion of dispatch summary tab window **60** includes additional data fields for each of first, second and third responder times **191** comprising: unit dispatched **192**, unit notified **193**, unit responding **194**, arrival at scene **195**, arrival at patient **196**, dispatched from scene **197**, arrival at destination **198**, and unit back in service **199**. The data in the dispatch summary tab window can be entered into the system by rescue personnel either at the cardiac rescue scene and during continuing emergency medical service (e.g., transport to a hospital), or can be entered into the single screen user interface at base computer **34** at a later time with information obtained from the rescue dispatch team after the rescue team reports its activities back to the rescue dispatch center.

FIGS. **6A–6B** show single screen user interface **40** with AED data tab window **62** selected, which includes the following data fields: AED serial number **200**, model num-

ber 202, AED operator 204, and AED history 206 including event 208 (AED lid opened, electrodes placed . . . , shock advised), actual time 210 (i.e., real time), elapsed time 212, and comments 214 as well as first defibrillating shock time 215, initial rhythm 216 (e.g., ventricular fibrillation), initial rhythm converted to rhythm 217 (e.g., ventricular fibrillation). Additional data fields in AED data tab window 62 primarily relate to UTSTEIN-style reporting of out-of-hospital cardiac arrests, and include: provider type of first CPR 218, time of first CPR 219A, time CPR discontinued 219B, witness type of cardiac arrest 220, witnessed cardiac arrest 221, confirmed cardiac arrest 222, initial cardiac rhythm shocked 223, and return of spontaneous circulation (ROSC) 224, cardiac etiology 225, resuscitation attempted 226. Finally, tab window 62 includes display AED operating parameters look-up window 227, and battery information look-up window 228. Most of the AED- and ECG-related data fields in AED data tab window 62 is automatically entered into the method and system of the present invention when this data is downloaded from AED 22 into rescue scene computer 26 and/or base computer 34. Of course, those data fields not filled in by data from AED 22 are filled in manually by an operator at the rescue scene or at a later time by a reviewer.

FIG. 7A shows single screen user interface 40 with review tab window 64 selected, which includes the following data fields: date of review 230, emergency room information 232, intensive care unit information 234, hospital information 236. This information is entered into the system by the reviewer away from the cardiac rescue scene. Emergency room information 232 , intensive care unit information 234, and hospital information 236 each include the following data fields: admitted to ER (or ICU or hospital) 240, name of ER (or ICU or hospital) 242, admission date 244, admission time 246, discharge date 248, discharge time 250, and patient died within 24 hours 252. Hospital information 236 further includes the data field, alive after one year of discharge 254. FIG. 7B shows a lower portion of review tab window 64, which includes the following additional data fields: updated Glasgow evaluation 255 (including eye opening, verbal, and motor components, with total score), patient status 256 (including alive, alive after first year, scene of death, date of death, and time of death), and review status 258 (including review completed, review due date, reviewer name).

FIG. 8 shows single screen user interface 40 with AED and responder evaluation tab window 66 selected, and which includes the following data fields: bystanders stand clear instruction 260, airway intervention 262, patient not conscious, not breathing, and no pulse 264, AED function properly 266, incident investigation required 268, AED deliver one or more shocks 270, AED applied to appropriate patient 272, CPR initiated at appropriate time 274, CPR resumed at appropriate times 276, EMS arrive at patient's side during incident 278, and score 280. This evaluation tab window is used for evaluating the AED and AED operator performance.

FIG. 9 shows single screen user interface 40 with notes tab window 68 selected. This tab window is for provided for a reviewer to make notes regarding any aspect of the cardiac rescue under review.

The system and method of the present invention is also capable of generating many types of reports by grouping a selected combination of data fields from one or more tab windows from single screen user interface 40. FIG. 10 shows an UTSTEIN data report 300 on cardiac arrest incidents for ventricular tachycardia with no-bystander CPR. This report follows the Utstein Style Guidelines for Uniform Reporting of Data from Out-of-Hospital Cardiac Arrest. Reports similar to report 300 are available for ventricular tachycardia with bystander CPR, ventricular fibrillation with no-bystander CPR, ventricular fibrillation with bystander CPR, asystole with no-bystander CPR, and asystole with bystander CPR. Each UTSTEIN report includes the following data fields: service area 310, population served 312, confirmed cardiac arrests considered for resuscitation 314, resuscitations attempted 316, resuscitations not attempted 318, cardiac etiology 320, non-cardiac etiology 322, arrest witnessed (bystanders) 324, arrest not witnessed 326, arrest witnessed (EMS personnel) 328, initial rhythm VT 330, other initial rhythms 332, no bystander CPR 334, bystander CPR 336, any resuscitation on spontaneous circulation (ROSC) 338, never achieved (ROSC) 340, admitted to ICU/ward 342, efforts ceased 344 (expired in field or in ED), discharged alive 346, expired in hospital 348 (total or within 24 hours), alive at one year 350, and expired within one year of discharge 352.

Many other reports can be obtained which provide a print out of a selected combination of data fields from one or more tab windows of single screen user interface 40. For example, standard reports include dispatch summary, incident summary, post-market surveillance, ECG summary, and patient follow-up, etc.

In addition to managing the effectiveness of a single or multiple cardiac rescue event, the system and method of the present invention also can be used to track the use and location of AEDs as well as facilitate training of AED operators.

FIG. 11 shows single screen user interface 40 with optional AED deployment tracking tool window 400 selected, which includes the following data fields: AED operator 402, AED/Battery information 404, and AED location 406. AED/battery information 404 further includes serial number 410, model number 412, AED ID 414, and battery ID 416. AED location 406 further includes type of location 418 (e.g., ground), VIN 420, address 422 (street, city, state, zip, telephone), and geographic code 424. Of course, most of this AED data will be loaded into these data fields automatically when the AED data from AED 22 is transmitted from AED 22 into rescue scene computer 26 and then into base computer 34.

FIG. 12 shows single screen user interface 40 with optional operator training tool window 430 selected, which includes the following data fields: operator trained 432 (name, ID, title) and both AED training specifics 434 and CPR training specifics 436, each including training performed by, date of last training, total number of hours trained, further training by. This data facilitates training of AED operators and tracking of who and how many people are trained AED operators.

The system and method of the present invention have numerous advantageous features. First, a programmed rescue scene computer permits user-observed patient and incident data to be transmitted simultaneously with transmission of ECG data and AED data from the rescue scene to a base computer. This on-scene data collection and simultaneous transmission with the ECG data permits the AED to remain in the field for nearly immediate use in another cardiac rescue event. Second, once the ECG data, AED data, and non-ECG data (patient and incident information, etc.) are in the system, the ECG data is selectively displayed simultaneously with AED data and/or non-ECG patient and incident data on a single screen graphical user interface. This feature

greatly facilitates review of the data and ECG since the reviewer need not switch back and forth between a non-ECG data or notes/review screen and the ECC data screen during review. Third, ECG data and AED data imported from the AED, as well as non-ECG data such as patient and incident data, are automatically registered with corresponding predetermined NHSTA codes (or other desired codes) to permit later reporting of the cardiac rescue data in national reporting formats. The NHSTA code registry can be modified on a code-by-code basis and can be selectively deactivated. Fourth, the data fields are based on an Open Database Connectivity (ODBC) format to permit import and export of cardiac rescue data to and from other emergency medical event database management systems, as well as permitting customized reporting by using another ODBC reporting database management software. Together, these features elevate cardiac emergency medical system management to a new level, providing comprehensive and coherent integration of all event and post-event data into a single system. This system and method permits internal or national reporting and rapid assessment and evaluation of the cardiac rescue event. Over time, this system and method will contribute greatly to future benchmarking of cardiac rescue event responses and management, particularly those involving AEDs.

What is claimed is:

1. A method of managing cardiac rescue events comprising the steps of:

performing a cardiac rescue on a patient at a cardiac rescue site with an automated external defibrillator (AED);

collecting ECG data at the cardiac rescue event at the cardiac rescue site; and

collecting automated AED rescue data of the cardiac rescue event at the cardiac rescue site presenting the ECG data and AED rescue data on a screen of a rescue scene computer at the cardiac rescue site.

2. The method of claim 1 and further comprising:

displaying the ECG data graphically on a display screen simultaneously with the non-ECG rescue data.

3. The method of claim 1 further comprising:

reviewing the cardiac rescue event by viewing the ECG data on the display screen; and

inputting analytical observations regarding the cardiac rescue event during the reviewing step.

4. The method of claim 2 further including displaying the ECG data graphically in real time.

5. The method of claim 1 further including the step of displaying the ECG data and AED rescue data in a real time enactment of the cardiac rescue event.

6. The method of claim 1 further comprising:

collecting AED rescue data including at least one of the following:

patient information, rescue scene location information, incident and rescue scene assessment information, patient vitals and therapy information, therapy information, rescue dispatch and response information, and AED operator performance information.

7. The method of claim 6 further comprising:

collecting incident information/rescue scene assessment including chief complaint, cause of injury, provider impression, pre-existing condition, signs and symptoms, injury description, injury intent, incident/patient disposition, safety equipment, factors affecting EMS delivery, suspected drug or alcohol abuse.

8. The method of claim 1 further comprising:

collecting patient vitals and therapy information including respiratory rate, respiratory effort, blood pressure, skin perfusion and Glasgow information including eye opening, verbal component, motor component, coma score, and therapy including therapy provider, therapy name, and time of therapy.

9. The method of claim 1 further comprising:

collecting dispatch and response information including at least one of the following: responder facility, vehicle type, dispatch ID and crew members, lights used, sirens used, location of hospital patient transported to, unit dispatched, unit notified, unit responding, arrival at scene, arrival at patient, departure from scene, arrival at destination, and unit back in service.

10. The method of claim 1 further comprising:

collecting AED rescue data including at least one of the following: an AED serial number, AED model number, AED operator, the real time of and occurrence of the following events: AED lid opening, electrode placement on patient, start of analysis, electrode checking, start of charge, advising operator of shock, delivering shock to patient.

11. The method of claim 1 further comprising:

collecting AED rescue data including at least one of the following: first defibrillating shock time, initial rhythm, initial rhythm conversion.

12. The method of claim 1 further comprising:

collecting AED rescue data including at least one of the following: provider type of first CPR, time of first CPR, time CPR discontinued,

witness type of cardiac arrest, witnessed cardiac arrest, confirmed cardiac arrest, initial cardiac rhythm shocked, return of spontaneous circulation, cardiac etiology, and resuscitation attempted.

13. The method of claim 1 further comprising:

collecting review data including at least one of the following: review date; admitted to ER, ICU, or hospital; name of ER, ICU, or hospital; admission date; admission time; discharge date; discharge time; patient died within 24 hours; alive after one year of discharge; update Glasgow evaluation including eye opening, verbal, and motor components; patient status including alive, alive after first year, scene of death, date of death, and time of death; and review status including review completed, review due date, reviewer name.

14. The method of claim 13 further comprising:

establishing a link between a predetermined NHTSA code to a corresponding ECG data or AED rescue data.

15. The method of claim 1 further comprising:

operably communicatively coupling the AED to the rescue site computer for the automated interchange of certain data therebetween; and

embedding the predetermined NHSTA code in a background of active data fields to permit selective activation, deactivation, modification, and/or initialization thereof.

16. The method of claim 1 further comprising simultaneously presenting the ECG data and AED rescue on a single screen graphical user interface of the rescue scene computer.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,321,113 B1
DATED : November 20, 2001
INVENTOR(S) : William S. Parker, Patrick J. Splinter, Sara M. Lindseth and Matthew G. Bradley

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Item [75], Inventors, please change "**Sarah Lindseth**" to -- **Sara Lindseth** --.

Signed and Sealed this

Sixth Day of August, 2002

Attest:

Attesting Officer

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

US006629131B1

(12) **United States Patent**
Choi

(10) **Patent No.: US 6,629,131 B1**
(45) **Date of Patent: Sep. 30, 2003**

(54) **REGISTRATION MAIL SYSTEM WITH A SENT E-MAIL CHECK FUNCTION ON INTERNET AND METHOD FOR THE SAME**

(75) Inventor: **Woo Jin Choi**, Seoul (KR)

(73) Assignee: **Nexen Co., Ltd.**, Seoul (KR)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/390,666**

(22) Filed: **Sep. 7, 1999**

(51) **Int. Cl.**[7] **G06F 15/16**

(52) **U.S. Cl.** **709/206**; 709/207; 709/311; 707/104.1; 379/93.01; 379/93.24

(58) **Field of Search** 709/206, 207, 709/311; 379/93.01, 93.24; 707/104.1

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,781,901	A *	7/1998	Kuzma	358/402
6,108,688	A *	8/2000	Nielsen	709/206
6,175,859	B1 *	1/2001	Mohler	709/206
6,185,551	B1 *	2/2001	Birrell et al.	707/102
6,202,086	B1 *	3/2001	Maruyama et al.	358/434
6,226,670	B1 *	5/2001	Ueno et al.	340/10.1
6,289,212	B1 *	9/2001	Stein et al.	455/412
6,308,206	B1 *	10/2001	Singh	709/223
6,314,454	B1 *	11/2001	Wang et al.	358/402
6,332,164	B1 *	12/2001	Jain	709/203
6,393,456	B1 *	5/2002	Ambler et al.	709/200

* cited by examiner

Primary Examiner—Zarni Maung
Assistant Examiner—Jinsong Hu
(74) *Attorney, Agent, or Firm*—Schweitzer Cornman Gross & Bondell LLP

(57) **ABSTRACT**

An electronic mailing method on the Internet with a function of reception confirmation is described. The method is comprising the steps of (a) assigning a unique code to the e-mail of a sender and recording the unique code in a database; (b) attaching to the e-mail a CGI executive program that automatically sends the unique code to the web server of the sender when the receiver receives the e-mail; (c) sending the unique code to the web server of the sender by the automatic execution of the CGI executive program when the e-mail is received by the receiver; and (d) comparing the unique code sent in the step (c) and the unique code recorded in the step (a) and, if they are identical, sending reception confirmation information to the sender.

3 Claims, 5 Drawing Sheets

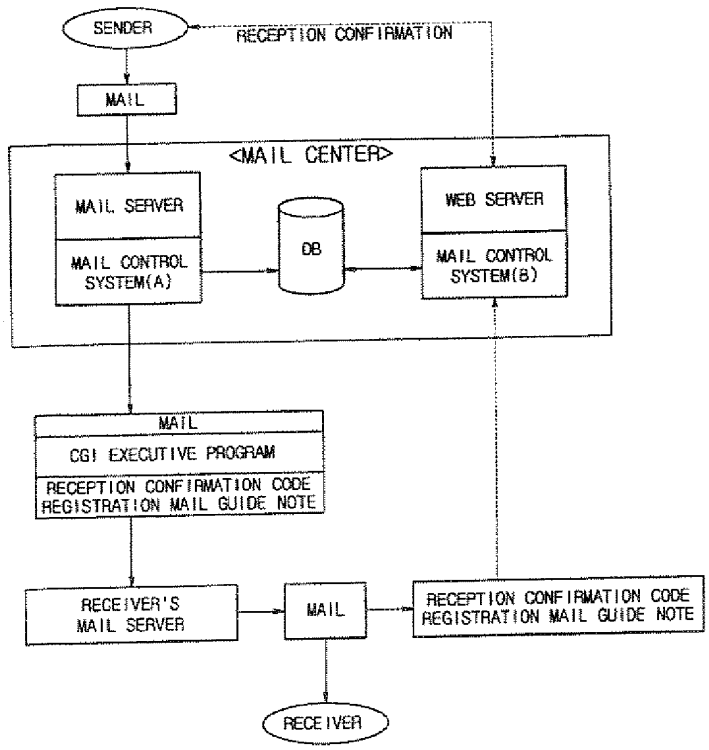


Fig. 1

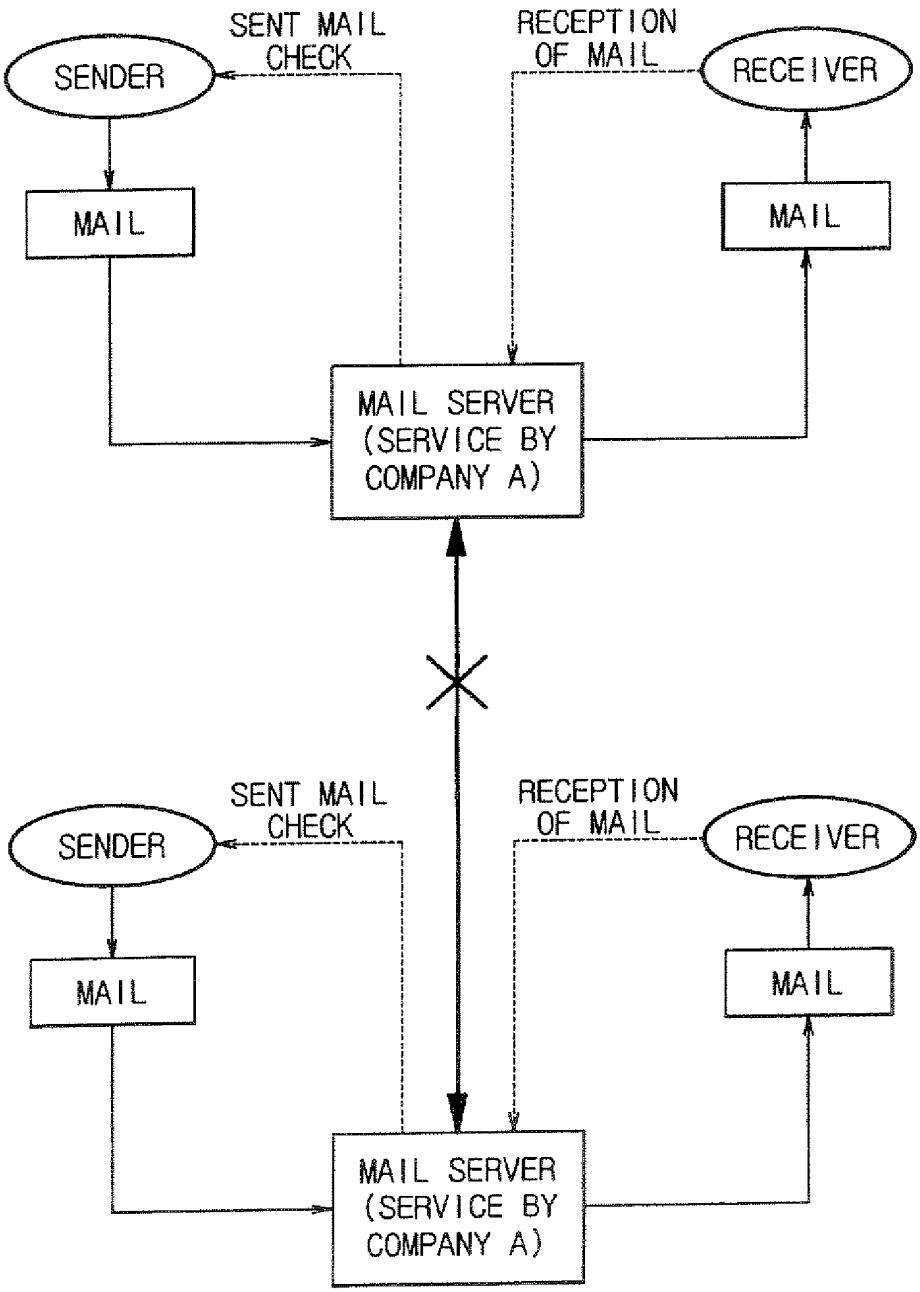

SENT MAIL CHECK
RECEPTION OF MAIL
SENDER
RECEIVER
MAIL
MAIL
MAIL SERVER (SERVICE BY COMPANY A)
SENT MAIL CHECK
RECEPTION OF MAIL
SENDER
RECEIVER
MAIL
MAIL
MAIL SERVER (SERVICE BY COMPANY A)

Fig.2

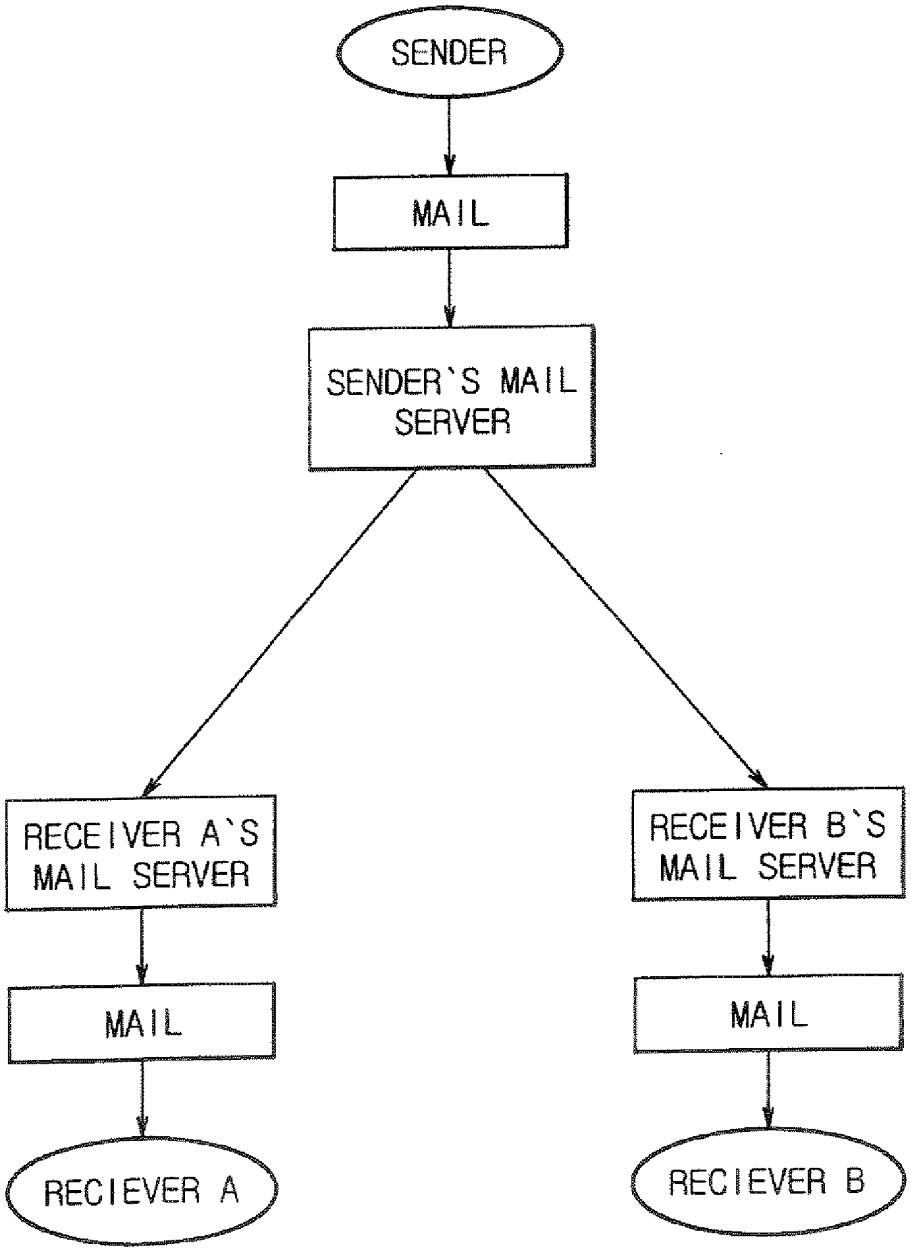

SENDER
MAIL
SENDER`S MAIL SERVER
RECEIVER A`S MAIL SERVER
MAIL
RECIEVER A
RECEIVER B`S MAIL SERVER
MAIL
RECIEVER B

Fig.3

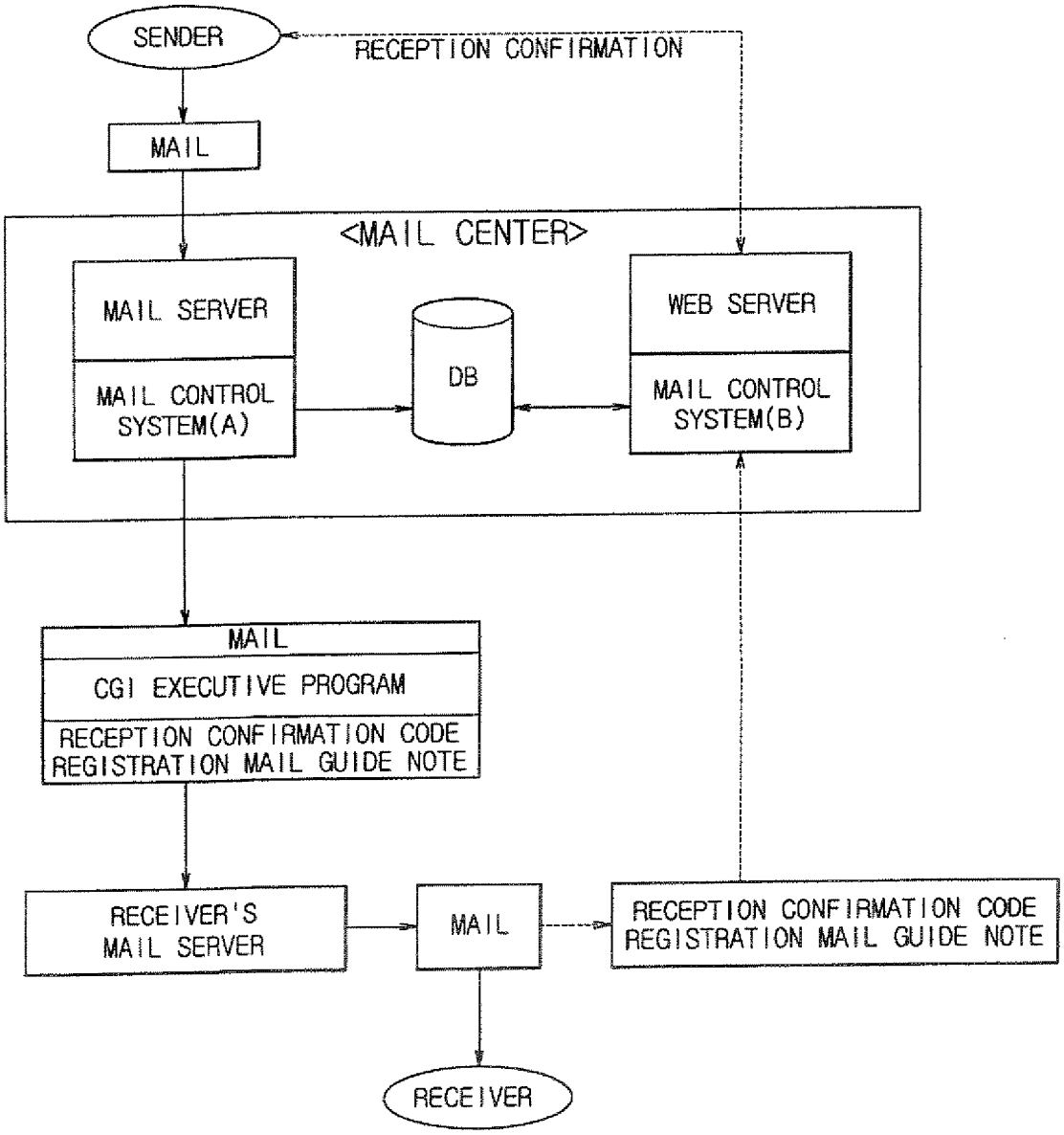

SENDER
RECEPTION CONFIRMATION
MAIL
<MAIL CENTER>
MAIL SERVER
MAIL CONTROL SYSTEM(A)
DB
WEB SERVER
MAIL CONTROL SYSTEM(B)
MAIL
CGI EXECUTIVE PROGRAM
RECEPTION CONFIRMATION CODE REGISTRATION MAIL GUIDE NOTE
RECEIVER'S MAIL SERVER
MAIL
RECEPTION CONFIRMATION CODE REGISTRATION MAIL GUIDE NOTE
RECEIVER

Fig.4

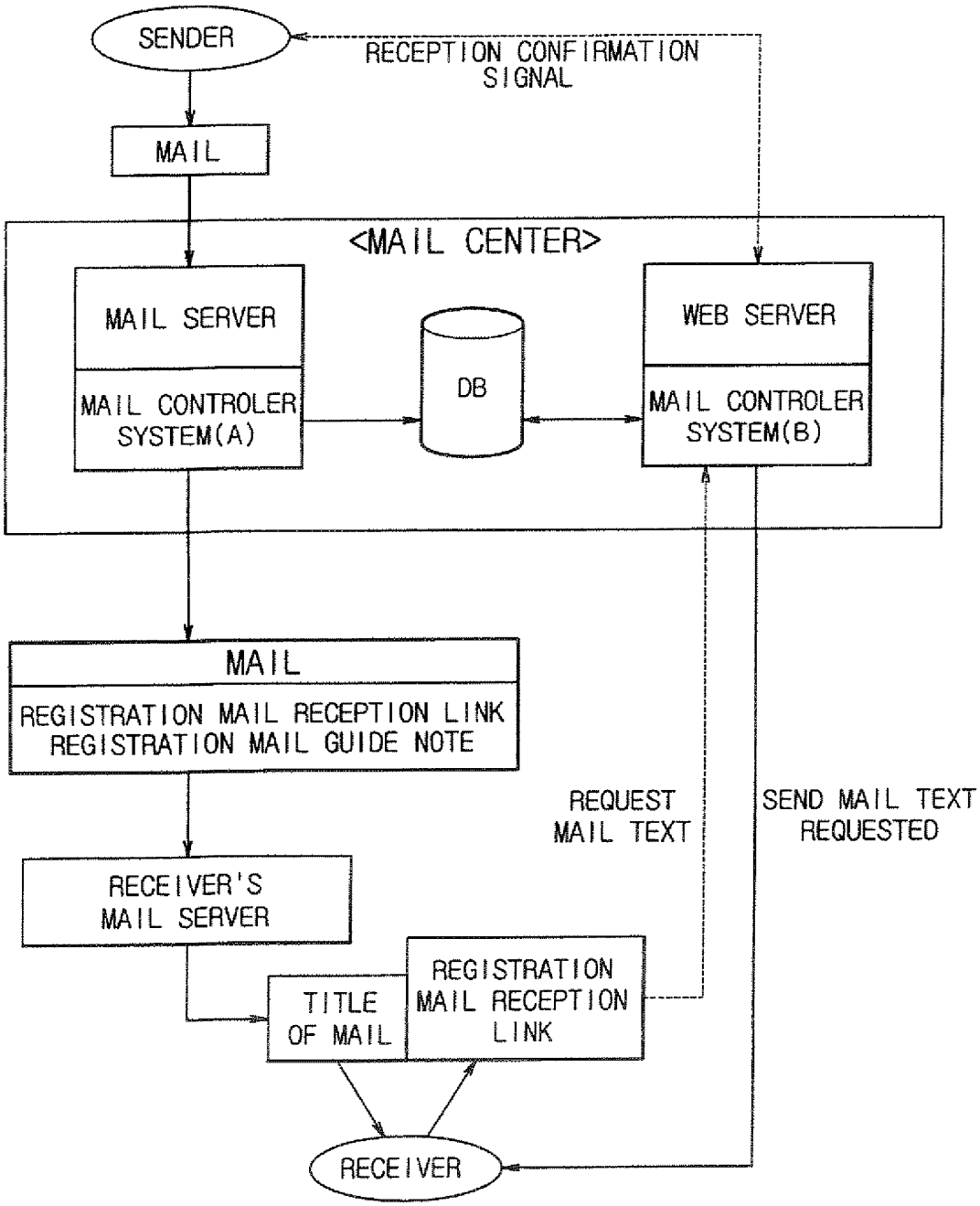
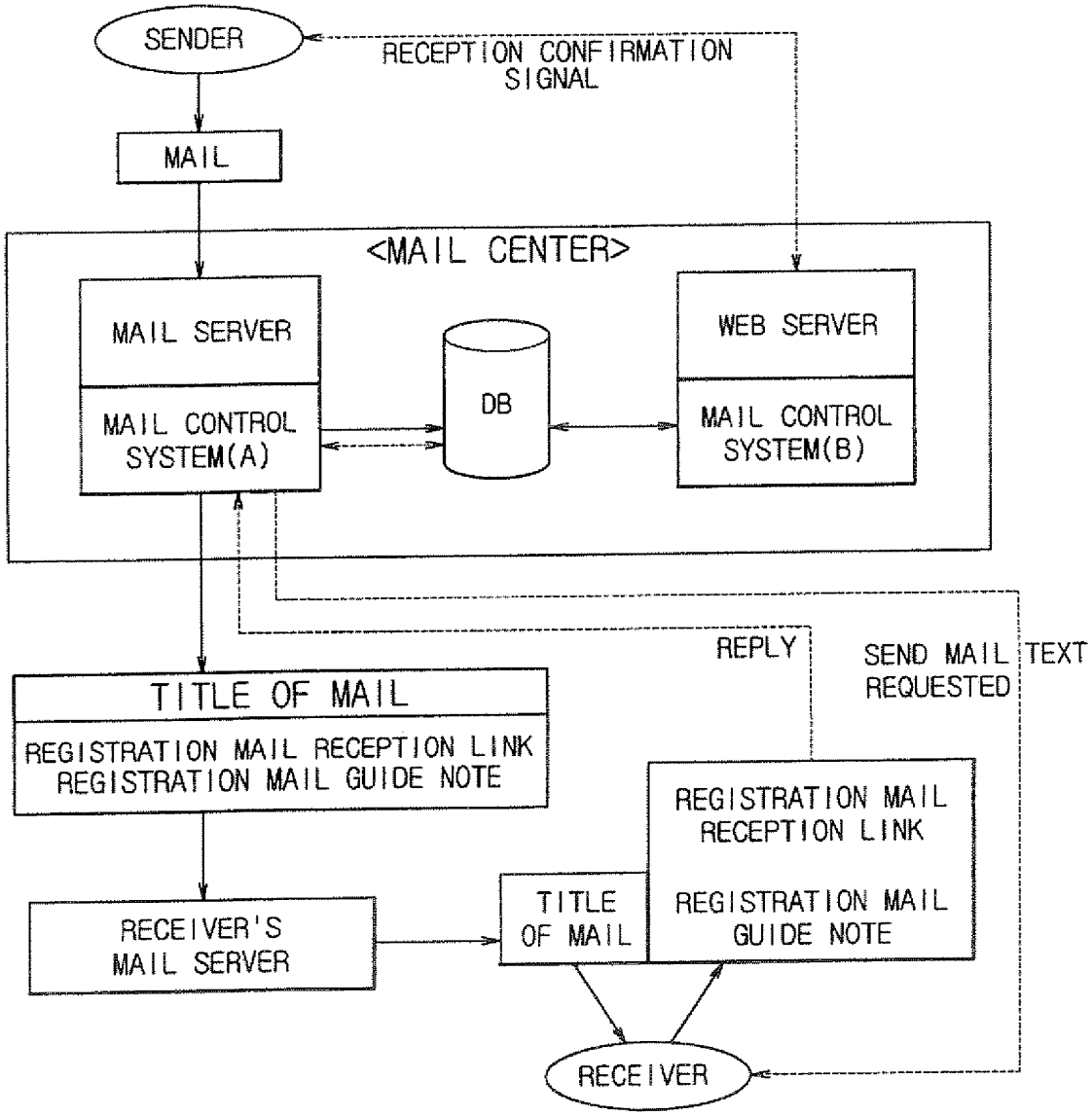

SENDER
RECEPTION CONFIRMATION SIGNAL
MAIL
<MAIL CENTER>
MAIL SERVER
MAIL CONTROLER SYSTEM(A)
DB
WEB SERVER
MAIL CONTROLER SYSTEM(B)
MAIL
REGISTRATION MAIL RECEPTION LINK
REGISTRATION MAIL GUIDE NOTE
REQUEST MAIL TEXT
SEND MAIL TEXT REQUESTED
RECEIVER'S MAIL SERVER
TITLE OF MAIL
REGISTRATION MAIL RECEPTION LINK
RECEIVER

Fig.5


SENDER
RECEPTION CONFIRMATION SIGNAL
MAIL
<MAIL CENTER>
MAIL SERVER
MAIL CONTROL SYSTEM(A)
DB
WEB SERVER
MAIL CONTROL SYSTEM(B)
REPLY
SEND MAIL TEXT REQUESTED
TITLE OF MAIL
REGISTRATION MAIL RECEPTION LINK
REGISTRATION MAIL GUIDE NOTE
REGISTRATION MAIL RECEPTION LINK
REGISTRATION MAIL GUIDE NOTE
TITLE OF MAIL
RECEIVER'S MAIL SERVER
RECEIVER

REGISTRATION MAIL SYSTEM WITH A SENT E-MAIL CHECK FUNCTION ON INTERNET AND METHOD FOR THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a mail system and method for solving the problem that a sender cannot check whether or not a receiver received (read) a mail in an internet environment (FIG. 2) that is a switching system among mail servers independently operated .

2. Description of Related Art

Existing PC communication services (e.g., Chollian, Hitel, Nownuri, and Unitel in Korea) each provides a sent e-mail check function in exchanging mail between its own service users. This is possible because the service is a single mail system. However, the mail exchange between users of different services cannot be achieved. Namely, messages can be exchanged by e-mail only between users registered in the same service (FIG. 1).

On the other hand, users can freely exchange their message by e-mail regardless of services in which they registered according to the mail exchange system in the internet environment. Therefore, the existing PC communication services tend to provide an internet mail service together and the communication tends to be used based upon internet mail IDs (e-mail addresses). However, the existing internet mail service cannot provide a function allowing a sender to check whether or not a receiver read the mail sent by the sender. This is because internet mails are exchanged between independent mail servers. In this system, the sender cannot check the mail that the sender has sent to the receiver's mail server (FIG. 2).

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a registration mail system with a sent e-mail check function on internet and method for the same that substantially obviates one or more of the limitations and disadvantages of the related art.

An objective of the present invention is to provide a registration mail system with a sent e-mail check function, wherein a unique code is given to each mail sent by a sender and recorded in a database (DB), a common gate interface (CGI) executive program through which the unique code and confirmation information are sent to a source mail system if a receiver reads the mail is attached to the mail itself which is sent to the receiver's mail server, if the receiver reads the mail, the unique code and confirmation information that have been sent to the mail center by the CGI executive program are compared with database information and recorded in the database, and confirmation of reception by the receiver is notified to the sender.

Additional features and advantages of the invention will be set forth in the following description, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure as illustrated in the written description and claims hereof, as well as the appended drawings.

To achieve these and other advantages, and in accordance with the purpose of the present invention as embodied and broadly described, the present invention employs a mail control system for assigning a unique code to a mail sent by a sender, recording the code in a database, and attaching a CGI executive program to the mail. The mail control system organically acts with a mail server and is in linkage with a database.

The present invention also employs another mail control system for comparing reception confirmation information from a receiver with database information, recording the confirmation information in the database, and sending an informing signal to the sender. This mail control system organically acts with a web server and is in linkage with the database.

When the receiver reads the mail in an off-line state, if a mail client application used by the receiver for reading the mail does not support a hypertext markup language (HTML), or if a text based emulator is used for reading the mail, the above system cannot be applied, so a registration mail system is developed as an extended type based upon the above system. In stead of using the program attached to the mail to process the reception confirmation information, the registration mail system stores the text of the mail therein and first sends only the information of a title of the mail, registration mail reception link, and registration mail guide note to the receiver. If the receiver requests the text of the mail, the registration mail system sends the text of the mail to the receiver and records the reception of the mail in the database.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE ATTACHED DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a block diagram showing a conventional mail system in PC communication;

FIG. 2 is a block diagram showing a conventional e-mail system in an internet environment;

FIG. 3 is a block diagram showing an overall structure of a mail system with a sent e-mail check function according to the present invention;

FIG. 4 is a block diagram showing an overall structure of an embodiment of a registration mail system with an extended sent e-mail check function according to the present invention; and

FIG. 5 is a block diagram showing an overall structure of another embodiment of a registration mail system with an extended sent e-mail check function according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

With reference to the accompanying drawings, the present invention will be described in detail.

FIG. 3 is a block diagram showing an overall structure of a mail system with a sent e-mail check function. Once a user composes a mail message and send it through this system, the mail is processed by a mail control system A which organically acts with a mail server. At this time, a unique code is assigned to the mail and the related information is recorded in a database. The mail control system A attaches the unique code and CGI executive program to the mail before sending it to the mail server of a receiver. If the

receiver reads the arrived mail, the CGI executive program is carried out so as to send information confirming the read of the message by the receiver and the unique code of the mail to a mail control system B in a mail center. The received mail code is compared with the mail codes previously recorded in the database to find the same mail code. Reception confirmation information is added to the corresponding mail record in the database. Thereafter, the mail control system B sends a reception confirmation signal to the sender. Furthermore, the sender can check the sent mail after accessing the web server anytime when necessary (FIG. 3).

A registration mail system extended from the above system is similar to the above system in that a unique code is assigned to a mail sent by a sender. However, differently from the above system, the text of the mail is separately stored and a registration mail reception link and a registration mail guide note (indicates registration mail receive method for a user checking e-mail with an emulator based upon text) are attached to the mail in the mail center before sending the mail to the receiver's mail server. Once the receiver receives (reads) the mail, the text of the mail stored is requested through the registration mail reception link attached to the mail. The mail text is then received by the receiver through direct connection. At this time, the mail control system B compares the unique code of the mail with the mail codes in the database and adds reception confirmation information to the record of the corresponding mail in the database. Subsequently, the mail control system B sends the reception confirmation signal to the sender. Furthermore, the sender can check the sent mail after accessing the web server anytime when necessary (FIG. 4).

However, if a mail client application used by the receiver for checking e-mail does not support HTML, or if the receiver checks the e-mail using the text based emulator, the above system cannot be applied. In this occasion, once the receiver just replies according to the content of the registration mail guide note, the mail control system A requests the text of the mail stored in the DB and sends it to the receiver. The mail control system A compares the unique code of the mail with the mail codes recorded in the DB and adds the reception confirmation information to the record of the corresponding mail. Thereafter, the mail control system B sends the reception confirmation signal to the sender. Furthermore, the sender can check the sent mail after accessing the web server anytime when necessary (FIG. 5).

Consequently, the present invention makes it possible to use a sent mail check function on internet, thereby overcoming the defect of the internet e-mail that has been the main method for mail exchange.

As illustrated, the present invention embodies an internet mail system supporting a sent mail check function. This is sufficiently important to the part of e-mail as means of communication. For example, when the e-mail is used for business, there may be some cases the success of the business depends on whether or not the receiver reads within a certain time limit. There may be some cases that reception itself is refused or that a sender cannot check whether or not the receiver reads the mail by phone or other means. The sent mail check function is very important to the sender in these cases as well as daily mail exchange. In case a receiver uses a plurality of e-mail addresses, the present invention makes it possible for a sender to find and send e-mail to the receiver's e-mail address that is not used frequently. As illustrated, the sent mail check function is very useful. As internet e-mail becomes more important and necessary as means of communication, effect of the sent mail check function achieved by the present invention increases.

It will be apparent to those skilled in the art that various modifications and variations can be made in the registration mail system with a sent e-mail check function on internet and method for the same of the present invention without deviating from the spirit or scope of the invention. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. An electronic mailing method on the Internet with a function of reception confirmation comprising:

(a) assigning a unique code to an e-mail of a sender and recording in a database the information on the unique code assigned to the e-mail;

(b) attaching to the e-mail, to which the unique code was assigned in the step of (a), a CGI (common gateway interface) executive program that automatically sends to the web server of the sender the unique code that was assigned in the step (a) when the receiver receives the e-mail;

(c) sending the unique code of the received e-mail to the web server of the sender by the automatic execution of the CGI executive program when the e-mail, to which the unique code was assigned in the step of (a) and to which the CGI executive program was attached in the step of (b), is received by the receiver; and

(d) comparing the unique code of e-mail that was sent in the step (c) and the unique code that was recorded in the step (a) and, if they are identical, sending reception confirmation information to the sender.

2. An electronic mailing method on the Internet with a function of receipt confirmation, comprising the steps of:

(a) assigning a unique code to an e-mail sent by a sender and storing the unique code in a database;

(b) attaching a CGI executive program to the e-mail containing the unique code of step (a) in order to transmit the unique code which is assigned to the e-mail in step (a), to an e-mail system of the sender upon a receiver's receipt of the e-mail;

(c) transmitting the unique code of the e-mail received by the receiver to the e-mail mail system of the sender by an automatic execution of the CGI executive program upon the receiver's receipt of the e-mail which contains the unique code and the CGI executive program of step (b); and

(d) delivering receipt confirmation information to the sender of the e-mail if the unique code of the e-mail transmitted in step (c) is identical to the information stored in the database.

3. An electronic mailing system on the Internet with a function of receipt confirmation, comprising:

a first mail control system having a mail processor part which assigns a unique code to e-mail sent by a sender, attaches a CGI executive program for e-mail transmitting the assigned unique code to the electronic mailing system upon a receiver's receipt of the e-mail, and transmits the e-mail to the receiver's mail server;

a database in which the unique code assigned by the mail processor part is recorded; and

a second mail control system having a receipt confirmation part which receives the unique code of the e-mail transmitted by automatic execution of the CGI executive program, compares the transmitted unique code with the unique code recorded in the database, and transmits receipt confirmation information to the sender if the two unique codes are identical.

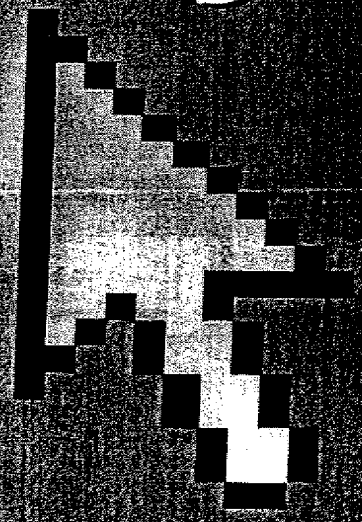
* * * * *

Microsoft

OVER 10,000 ENTRIES

Microsoft Computer Dictionary

Fifth Edition



- *Fully updated with the latest technologies, terms, and acronyms*
- *Easy to read, expertly illustrated*
- *Definitive coverage of hardware, software, the Internet, and more!*

PUBLISHED BY
Microsoft Press
A Division of Microsoft Corporation
One Microsoft Way
Redmond, Washington 98052-6399

Library of Congress Cataloging-in-Publication Data
Microsoft Computer Dictionary.--5th ed.
p. cm.
ISBN 0-7356-1495-4
1. Computers--Dictionaries. 2. Microcomputers--Dictionaries.

AQ76.5. M52267 2002
004'.03--dc21 200219714

Printed and bound in the United States of America.

2 3 4 5 6 7 8 9 QWT 7 6 5 4 3 2

Distributed in Canada by H.B. Fenn and Company Ltd.

A CIP catalogue record for this book is available from the British Library.

Microsoft Press books are available through booksellers and distributors worldwide. For further information about international editions, contact your local Microsoft Corporation office or contact Microsoft Press International directly at fax (425) 936-7329. Visit our Web site at www.microsoft.com/mspress. Send comments to *mspinput@microsoft.com*.

Acquisitions Editor: Alex Blanton
Project Editor: Sandra Haynes

Body Part No. X08-41929

CORBA *n.* Acronym for Common Object Request Broker Architecture. A specification developed by the Object Management Group in 1992 in which pieces of programs (objects) communicate with other objects in other programs, even if the two programs are written in different programming languages and are running on different platforms. A program makes its request for objects through an *object request broker*, or *ORB*, and thus does not need to know the structure of the program from which the object comes. CORBA is designed to work in object-oriented environments. *See also* IIOP, object (definition 2), Object Management Group, object-oriented.

core *n.* One of the types of memory built into computers before random access memory (RAM) was available or affordable. Some people still use the term to refer to the main memory of any computer system, as in the phrase *core dump*—a listing of the raw contents of main memory at the moment of a system crash. *Compare* RAM.

core class *n.* In the Java programming language, a public class or interface that is a standard member of the language. Core classes, at minimum, are available on all operating systems where the Java platform runs. A program written entirely in the Java programming language relies only on core classes. *See also* class (definition 1), object, object-oriented programming.

core program *n.* A program or program segment that is resident in random access memory (RAM).

coresident *adj.* Of or pertaining to a condition in which two or more programs are loaded in memory at the same time.

corona wire *n.* In laser printers, a wire though which high voltage is passed to ionize the air and transfer a uniform electrostatic charge to the photosensitive medium in preparation for the laser.

coroutine *n.* A routine that is in memory at the same time as, and frequently executed concurrently with, another.

corrective maintenance *n.* The process of diagnosing and correcting computer problems after they occur. *Compare* preventive maintenance.

correspondence quality *n.* *See* print quality.

corruption *n.* A process wherein data in memory or on disk is unintentionally changed, with its meaning thereby altered or obliterated.

cost-benefit analysis *n.* The comparison of benefits to costs for a particular item or action. Cost-benefit analysis is often used in MIS or IS departments to determine such things as whether purchasing a new computer system is a good investment or whether hiring more staff is necessary. *See also* IS, MIS.

coulomb *n.* A unit of electrical charge equivalent to roughly 6.26×10^{18} electrons, with a negative charge being an excess of electrons and a positive charge being a deficiency of electrons.

counter *n.* **1.** In programming, a variable used to keep count of something. **2.** In electronics, a circuit that counts a specified number of pulses before generating an output. **3.** A device that keeps track of the number of visitors to a World Wide Web site.

counting loop *n.* In a program, a group of statements that are repeated, thereby incrementing a variable used as a counter (for example, a program might repeat a counting loop that adds 1 to its counter until the counter equals 10). *See also* loop[1] (definition 1).

country code *n.* *See* major geographic domain.

country-specific *adj.* Of, pertaining to, or characteristic of hardware or software that uses characters or conventions unique to a particular country or group of countries. *Country-specific* does not necessarily refer to spoken languages, although it does allow for special characters (such as accent marks) that are language-specific. Generally, the features considered country-specific include keyboard layout (including special-character keys), time and date conventions, financial and monetary symbols, decimal notation (decimal point or comma), and alphabetic sorting order. Such features are handled either by a computer's operating system (for example, by the Keyboard and Country commands in MS-DOS) or by application programs that offer options for tailoring documents to a particular set of national or international conventions.

courseware *n.* Software dedicated to education or training.

courtesy copy *n.* *See* cc.

CPA *n.* *See* Computer Press Association.

CPCP *n.* *See* HTCPCP.

cpi *n.* *See* characters per inch.

CP/M *n.* Acronym for Control Program/Monitor. A line of operating systems from Digital Research, Inc. (DRI),

insider attack *n.* An attack on a network or system carried out by an individual associated with the hacked system. Insider attacks are typically the work of current or former employees of a company or organization who have knowledge of passwords and network vulnerabilities. *Compare* intruder attack.

Ins key *n. See* Insert key.

install *vb.* To set in place and prepare for operation. Operating systems and application programs commonly include a disk-based installation, or setup, program that does most of the work of preparing the program to work with the computer, printer, and other devices. Often such a program can check for devices attached to the system, request the user to choose from sets of options, create a place for the program on the hard disk, and modify system startup files as necessary.

installable device driver *n.* A device driver that can be embedded within an operating system, usually in order to override an existing, less-functional service.

Installable File System Manager *n.* In Windows 9x and Windows 2000, the part of the file system architecture responsible for arbitrating access to the different file system components. *Acronym:* IFS.

installation program *n.* A program whose function is to install another program, either on a storage medium or in memory. An installation program, also called a setup program, might be used to guide a user through the often complex process of setting up an application for a particular combination of machine, printer, and monitor.

installer *n.* A program, provided with the Apple Macintosh operating system, that allows the user to install system upgrades and make bootable (system) disks.

instance *n.* An object, in object-oriented programming, in relation to the class to which it belongs. For example, an object *myList* that belongs to a class *List* is an instance of the class *List*. *See also* class, instance variable, instantiate, object (definition 2).

instance variable *n.* A variable associated with an instance of a class (an object). If a class defines a certain variable, each instance of the class has its own copy of that variable. *See also* class, instance, object (definition 2), object-oriented programming.

instantiate *vb.* To create an instance of a class. *See also* class, instance, object (definition 2).

instant messaging *n.* A service that alerts users when friends or colleagues are on line and allows them to communicate with each other in real time through private online chat areas. With instant messaging, a user creates a list of other users with whom he or she wishes to communicate; when a user from his or her list is on line, the service alerts the user and enables immediate contact with the other user. While instant messaging has primarily been a proprietary service offered by Internet service providers such as AOL and MSN, businesses are starting to employ instant messaging to increase employee efficiency and make expertise more readily available to employees.

Institute of Electrical and Electronics Engineers *n. See* IEEE.

instruction *n.* An action statement in any computer language, most often in machine or assembly language. Most programs consist of two types of statements: declarations and instructions. *See also* declaration, statement.

instruction code *n. See* operation code.

instruction counter *n. See* instruction register.

instruction cycle *n.* The cycle in which a processor retrieves an instruction from memory, decodes it, and carries it out. The time required for an instruction cycle is the sum of the instruction (fetch) time and the execution (translate and execute) time and is measured by the number of clock ticks (pulses of a processor's internal timer) consumed.

instruction mix *n.* The assortment of types of instructions contained in a program, such as assignment instructions, mathematical instructions (floating-point or integer), control instructions, and indexing instructions. Knowledge of instruction mixes is important to designers of CPUs because it tells them which instructions should be shortened to yield the greatest speed, and to designers of benchmarks because it enables them to make the benchmarks relevant to real tasks.

instruction pointer *n. See* program counter.

instruction register *n.* A register in a central processing unit that holds the address of the next instruction to be executed.

instruction set *n.* The set of machine instructions that a processor recognizes and can execute. *See also* assembler, microcode.

Web applications, since users access the Web from many types of computers. Java is used in programming small applications, or applets, for the World Wide Web, as well as in creating distributed network applications. *See also* bytecode, Java applet, Jini, object-oriented programming.

Java applet *n.* A Java class that is loaded and run by an already-running Java application such as a Web browser or an applet viewer. Java applets can be downloaded and run by any Web browser capable of interpreting Java, such as Internet Explorer, Netscape Navigator, and HotJava. Java applets are frequently used to add multimedia effects and interactivity to Web pages, such as background music, real-time video displays, animations, calculators, and interactive games. Applets can be activated automatically when a user views a page, or they may require some action on the part of the user, such as clicking on an icon in the Web page. *See also* applet, Java.

JavaBean *n.* A Java component architecture defined in the JavaBeans specification developed by Sun Microsystems. A JavaBean, or Bean, is a reusable application component—an independent code segment—that can be combined with other JavaBean components to create a Java applet or application. The JavaBean concept emphasizes the platform-independence of the Java language, in which ideally a program, once written, can run on any computing platform. JavaBeans are similar to Microsoft's ActiveX controls. ActiveX controls, however, can be developed in different programming languages but executed only on a Windows platform. JavaBeans can be developed only in the Java programming language but ideally can run on any platform. *See also* ActiveX, Java.

ava Card *n.* An application programming interface API) from Sun Microsystems, Inc., that allows Java pplets and programs to run on smart cards and other evices with limited memory. Java Card uses a Java Card irtual Machine designed for severely memory-constrained devices. *See also* applets, Java Card Virtual achine, smart card (definition 2).

va Card Virtual Machine *n.* An ultra-small-footprint, ghly optimized foundation of a runtime environment thin the Java 2 Platform Micro Edition. Derived from the va Virtual Machine (JVM), it is targeted at smart cards d other severely memory-constrained devices. The Java rd Virtual Machine can run in devices with memory as all as 24 KB of ROM, 16 KB of EEPROM, and 512 es of RAM. *See also* EEPROM, Java Card, RAM,)M.

Java chip *n.* An implementation on a single integrated circuit of the virtual machine specified for execution of the Java programming language. Such chips, which are being developed by Sun Microsystems, Inc., could be used in very small devices and as controllers for appliances. *See also* integrated circuit, Java, virtual machine.

Java-compliant browser *n.* A Web browser with support for the Java programming language built into it. Most current Web browsers are Java-compliant. *See also* Java, Web browser.

Java Developer's Kit *n.* A set of software tools developed by Sun Microsystems, Inc., for writing Java applets or applications. The kit, which is distributed free, includes a Java compiler, interpreter, debugger, viewer for applets, and documentation. *Acronym:* JDK. *See also* applet, Java, Java applet.

Java Foundation Classes *n.* A Java-based set of class libraries developed by Sun Microsystems, Inc. Encompassing fundamentals of the Internet Foundation Classes created by Netscape Communications Corp., the Java Foundation Classes extend the Java Abstract Window Toolkit (AWT) by providing graphical user interface components for use in developing commercial and Internet-related Java applications. *See also* Abstract Window Toolkit, Application Foundation Classes, Internet Foundation Classes, Java, JavaBean, Microsoft Foundation Classes.

Java HotSpot *n.* A Java performance engine introduced by Sun Microsystems, Inc., in 1999 that is designed to run Java applications faster than just-in-time (JIT) compilers. The core of Java HotSpot, and the feature for which it is named, is its ability to perform adaptive optimization—the identification and optimization of "hot spots," or sections of performance-critical code. Improved garbage collection (freeing of memory occupied by objects no longer in use) and better multithreading are additional features designed to contribute to increased performance. *See also* Java.

Java IDL *n.* Short for **Java** Interface Definition Language. A Java technology that provides CORBA interoperability and connectivity capabilities for the Java platform. These capabilities enable Java applications to invoke operations on-remote network services using the Object Management Group Interface Definition Language and Internet Inter-ORB Protocol. *See also* CORBA, IDL, J2EE, RMI-IIOP.

JavaMail *n.* An API in the Sun Microsystems, Inc., Java platform for sending and receiving mail. A set of abstract APIs that model a mail system, JavaMail provides a platform-independent and protocol-independent

framework to build Java
See also application pro

Java Management Ap Interface *n.* A set of a face specifications, pro Inc., to enable the Java management. *Acronym* programming interface

JavaOS *n.* An operating tions written in the Java was created by JavaSof Microsystems, Inc., to (JVM) directly on micr need for a resident ope designed for network c ing from game machine *See also* Java.

JavaScript *n.* A script Netscape Communicat loosely related to Java. object-oriented langua compared with Java b online applications an pages with JavaScript, available application fewer than those avail which is included in a code, is generally con especially for novice p Web browser, such as Explorer, is necessar application programr language. *Compare* J

JavaServer Pages *n*

Java Speech Gram dent grammar descri speech recognition s mat is used extensive with most speech re cations. *Acronym:* J

Java Virtual Machi programs run. The J grams a software-bas (Programs, even the designed for childre environment from w

page layout *n.* In desktop publishing, the process of arranging text and graphics on the pages of a document. Page-layout programs excel in text placement and management of special effects applied to text. Although page-layout programs are generally slower than word-processing programs, they can perform such advanced tasks as flowing text into complex multicolumn page designs, printing documents in signatures, managing color separations, and supporting sophisticated kerning and hyphenation.

page makeup *n.* The assembling of graphics and text on a page in preparation for printing.

page mode RAM *n.* A specially designed dynamic RAM that supports access to sequential memory locations with a reduced cycle time. This is especially attractive in video RAM, in which each location is accessed in ascending order to create the screen image. Page mode RAM can also improve the execution speed of code because code tends to execute sequentially through memory. *See also* cycle time, dynamic RAM.

page orientation *n. See* landscape mode, portrait mode.

page printer *n.* Any printer, such as a laser printer, that prints an entire page at once. Because page printers must store the entire page in memory before printing, they require relatively large amounts of memory. *Compare* line printer.

pager *n.* Pocket-sized wireless electronic device that uses radio signals to record incoming phone numbers or short text messages. Some pagers allow users to send messages as well. *Also called:* beeper.

page reader *n. See* document reader.

page setup *n.* A set of choices that affect how a file is printed on the page. Page setup might reflect the size of paper going into the printer, the page margins, the specific pages in the document to be printed, whether the image is to be reduced or enlarged when printed, and whether another file is to be printed immediately after the first file is printed.

pages per minute *n. See* PPM.

Page Up key *n.* A standard key (often labeled "PgUp") on most computer keyboards whose specific meaning is different in different programs. In many cases, it moves the cursor up to the top of the previous page or a specific number of lines.

pagination *n.* 1. The process of dividing a document into pages for printing. 2. The process of adding page numbers, as in a running head.

paging *n.* A technique for implementing virtual memory. The virtual address space is divided into a number of fixed-size blocks called pages, each of which can be mapped onto any of the physical addresses available in the system. Special memory management hardware (MMU or PMMU) performs the address translation from virtual addresses to physical addresses. *See also* memory management unit, paged memory management unit, virtual memory.

paging file *n.* A hidden file on the hard disk that operating systems (such as Windows, Mac OS X, and UNIX) use to hold parts of programs and data files that do not fit in memory. The paging file and physical memory, or RAM, make up virtual memory. Data is moved from the paging file to memory as needed and moved from memory to the paging file to make room for new data in memory. *Also called:* swap file. *See also* virtual memory.

paint[1] *n.* A color and pattern used with graphics programs to fill areas of a drawing, applied with tools such as a paintbrush or a spraycan.

paint[2] *vb.* To fill a portion of a drawing with paint (color or a pattern).

paintbrush *n.* An artist's tool in a paint program or another graphics application for applying a streak of solid color to an image. The user can usually select the width of the streak. *See also* paint program. *Compare* spraycan.

paint program *n.* An application program that creates graphics as bit maps. A paint program, because it treats a drawing as a group of dots, is particularly appropriate for freehand drawing. Such a program commonly provides tools for images requiring lines, curves, and geometric shapes but does not treat any shape as an entity that can be moved or modified as a discrete object without losing its identity. *Compare* drawing program.

palette *n.* 1. In paint programs, a collection of drawing tools, such as patterns, colors, brush shapes, and different line widths, from which the user can choose. 2. A subset of the color look-up table that establishes the colors that can be displayed on the screen at a particular time. The number of colors in a palette is determined by the number of bits used to represent a pixel. *See also* color bits, color look-up table, pixel.

US006304898B1

(12) **United States Patent**
Shiigi

(10) **Patent No.: US 6,304,898 B1**
(45) **Date of Patent: Oct. 16, 2001**

(54) **METHOD AND SYSTEM FOR CREATING AND SENDING GRAPHICAL EMAIL**

(75) Inventor: **Clyde K. Shiigi**, Aiea, HI (US)

(73) Assignee: **Datahouse, Inc.**, Honolulu, HI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/687,351**

(22) Filed: **Oct. 11, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/159,636, filed on Oct. 13, 1999.

(51) **Int. Cl.**[7] **G06F 13/00**

(52) **U.S. Cl.** **709/206**; 709/219; 709/321; 709/328

(58) **Field of Search** 709/206, 217, 709/219, 250, 313, 317, 321, 322, 323, 328, 329

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,426,594	*	6/1995	Wright et al. .	
5,726,669	*	3/1998	Obata et al.	345/2
5,818,447	*	10/1998	Wolf et al.	345/335
5,880,740	*	3/1999	Halliday et al.	345/435
5,983,200	*	11/1999	Slotznick	705/26
6,003,007	*	12/1999	DiRienzo	705/4
6,054,990	*	4/2000	Tran	345/358
6,105,055	*	8/2000	Pizano et al. .	
6,212,535	*	4/2001	Weikart et al.	707/513

FOREIGN PATENT DOCUMENTS

410124178 * 5/1998 (JP) .

410260920 * 9/1998 (JP) .

OTHER PUBLICATIONS

Lotus White Paper, "Real Time Collaboration Standards", dated Oct. 1999, Lotus development Corp.

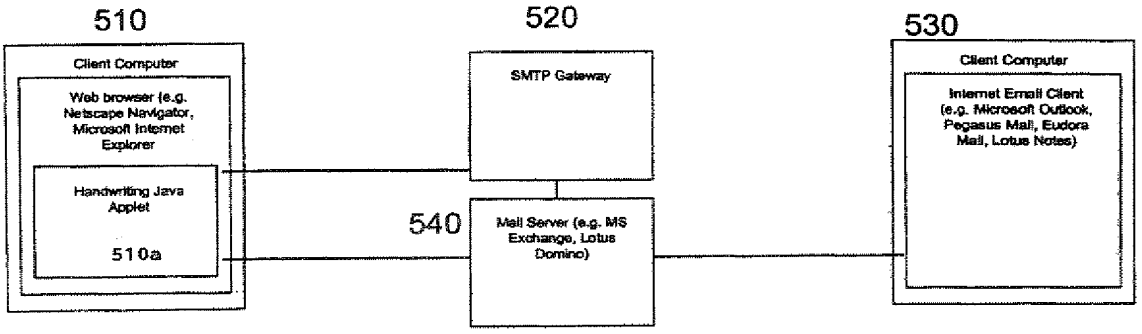
* cited by examiner

Primary Examiner—Viet D. Vu
(74) *Attorney, Agent, or Firm*—Leighton K. Chong

(57) **ABSTRACT**

An electronic messaging system, and related method, employs a handwriting server component operable on a network with an email host server, and a client component operable with an email client on a client computer connected to the network. The client component sets up a graphical data capture area into which a user can enter handwritten or handdrawn input through a suitable graphical input device. The handwritten or handdrawn input is captured and sent as pixel data or an attached graphics file with an email message. The preferred form of the handwriting messaging component is as a Java applet downloaded to the web page of the email client or installed as a plug-in with the email client. The graphical email message may be sent to a server having a Java-based handwriting server component, a Domino server, a real-time messaging server, a standard Internet email server, or an Internet email server with a WAP interface to wireless PDAs and other digital communications devices. The graphical input device can be a touch screen, pen input device, stylus pad, or even a standard mouse. The handwriting messaging component sets up a drawing editor/viewer that allows the user to compose, manipulate, send and view handwritten or handdrawn messages. The drawing editor/viewer can include a set of standard drawing tools and functions.

20 Claims, 11 Drawing Sheets



Handwriting Applet and Mail Server Version

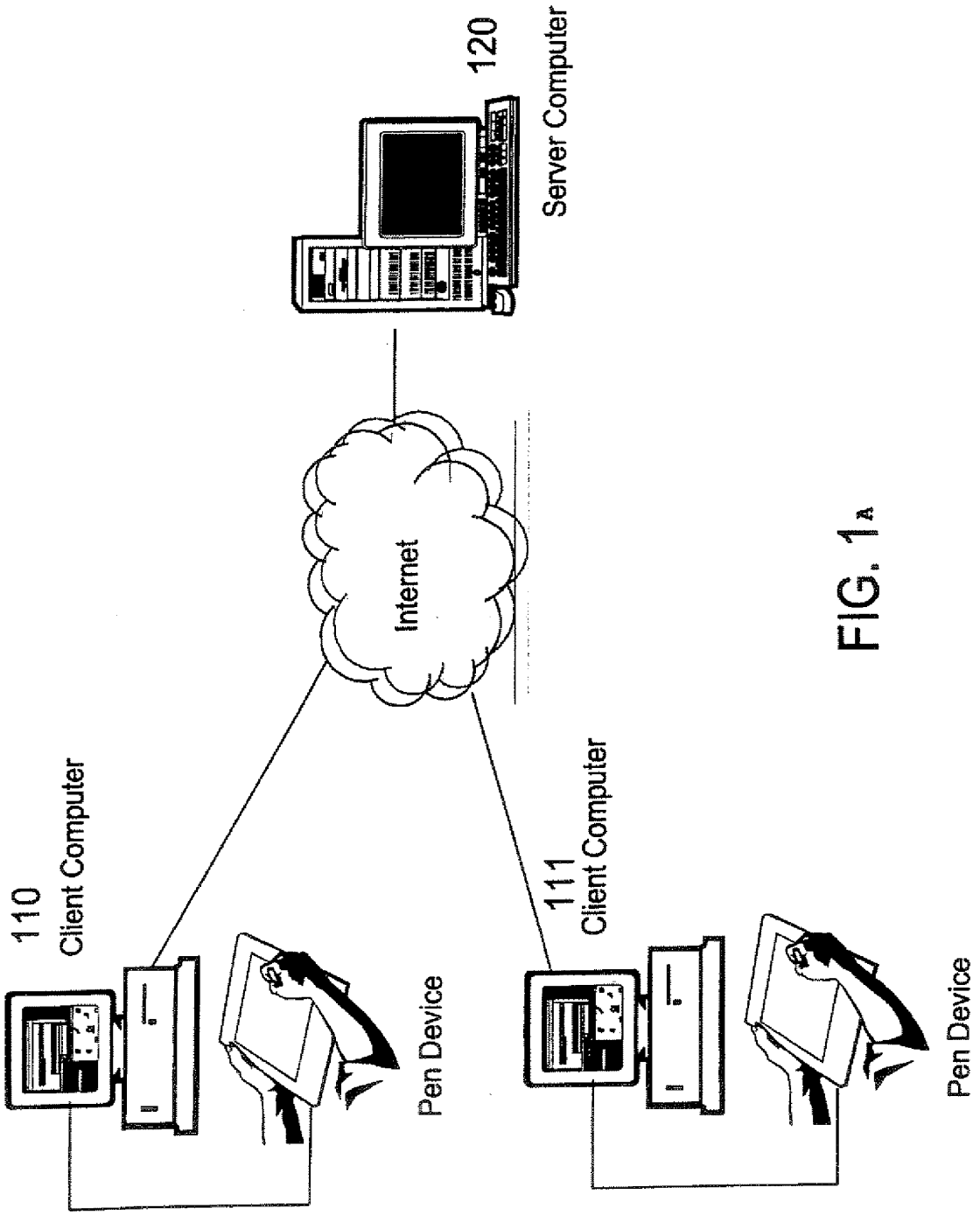

120
Server Computer
Internet
110
Client Computer
Pen Device
111
Client Computer
Pen Device

FIG. 1A

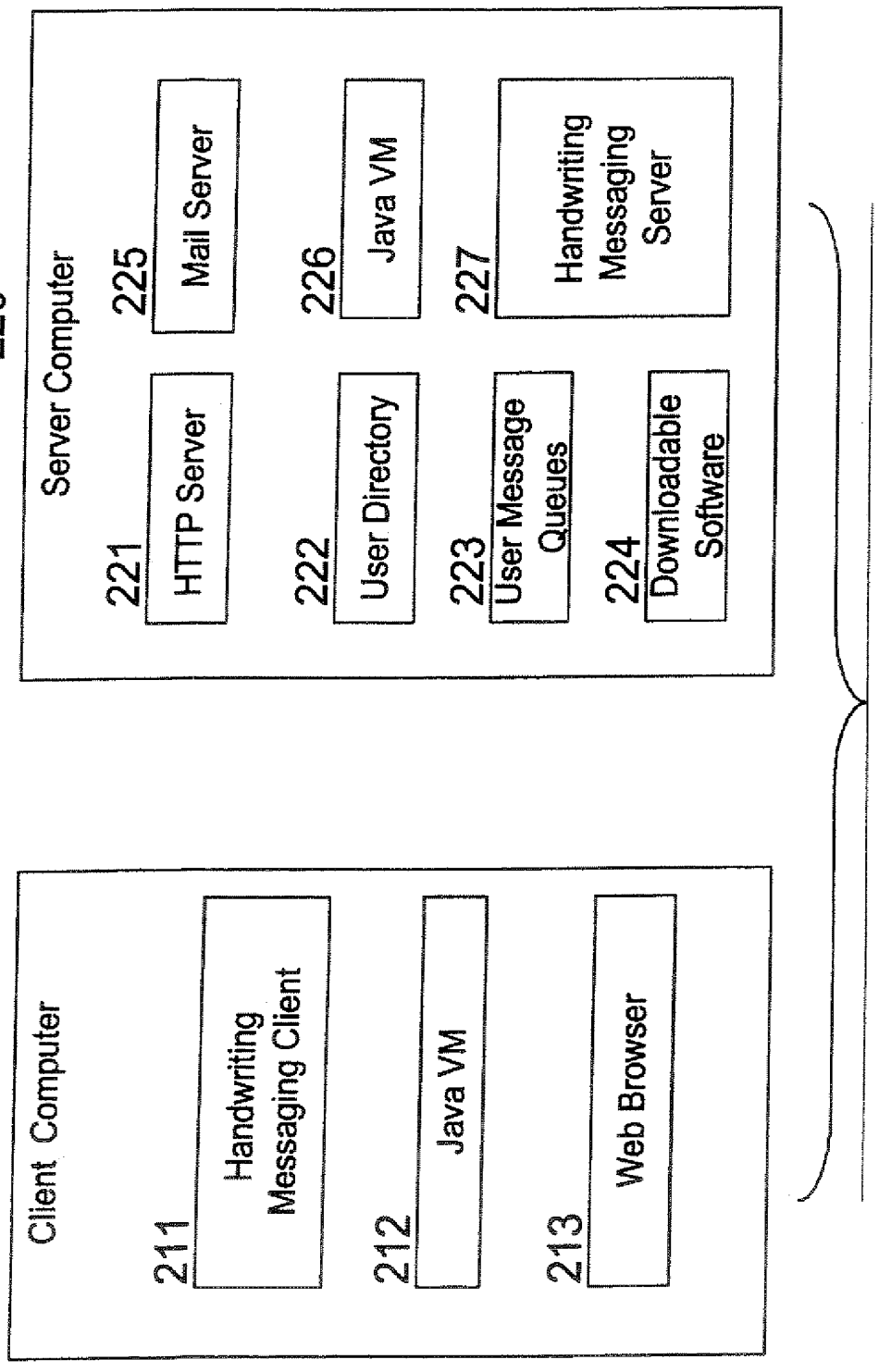

210
Client Computer
211
Handwriting Messaging Client
212
Java VM
213
Web Browser
220
Server Computer
221
HTTP Server
222
User Directory
223
User Message Queues
224
Downloadable Software
225
Mail Server
226
Java VM
227
Handwriting Messaging Server

FIG. 1B

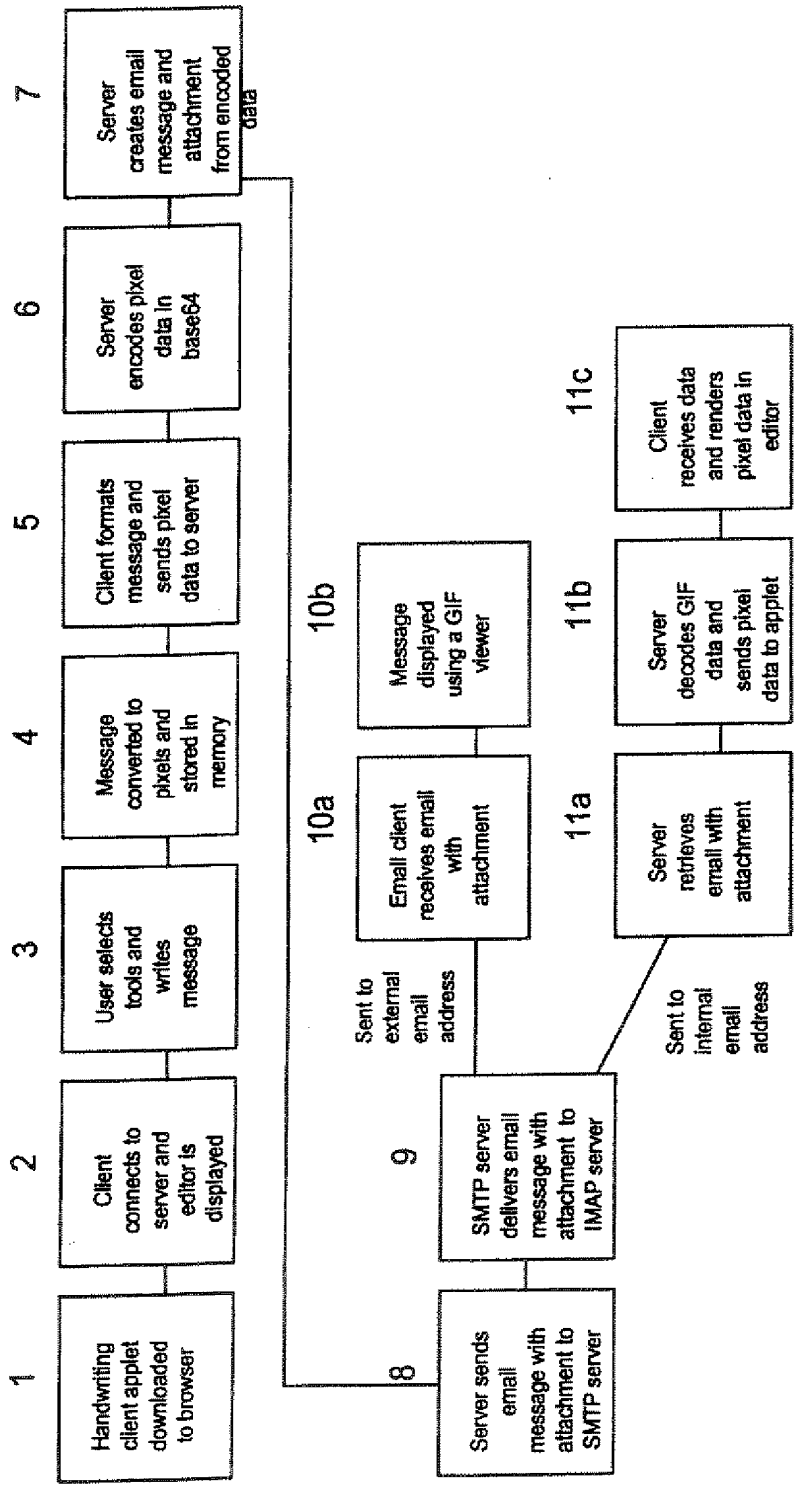


FIG. 2A

Handwriting Client and Handwriting Server Version

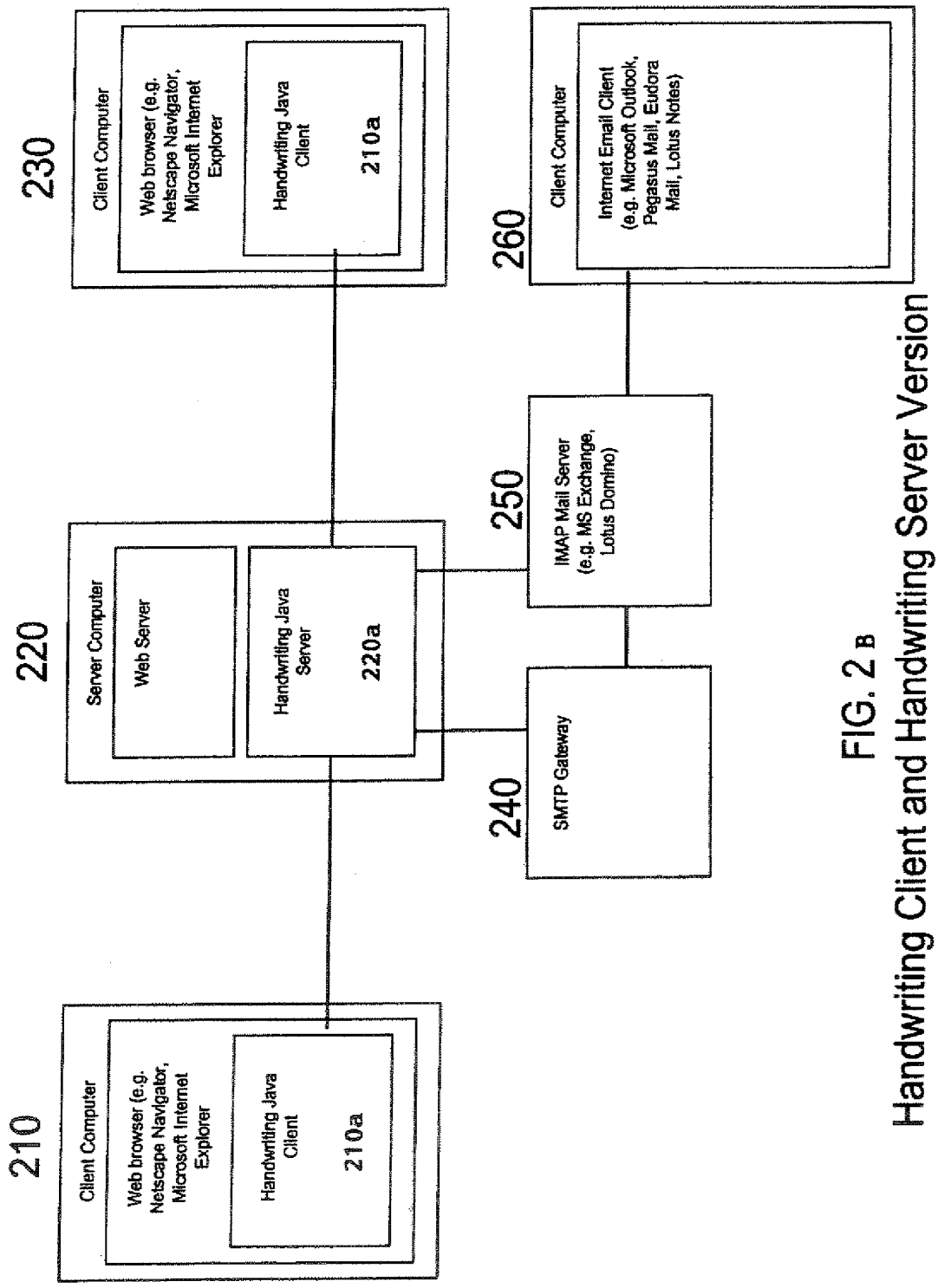


FIG. 2B

Handwriting Client and Handwriting Server Version

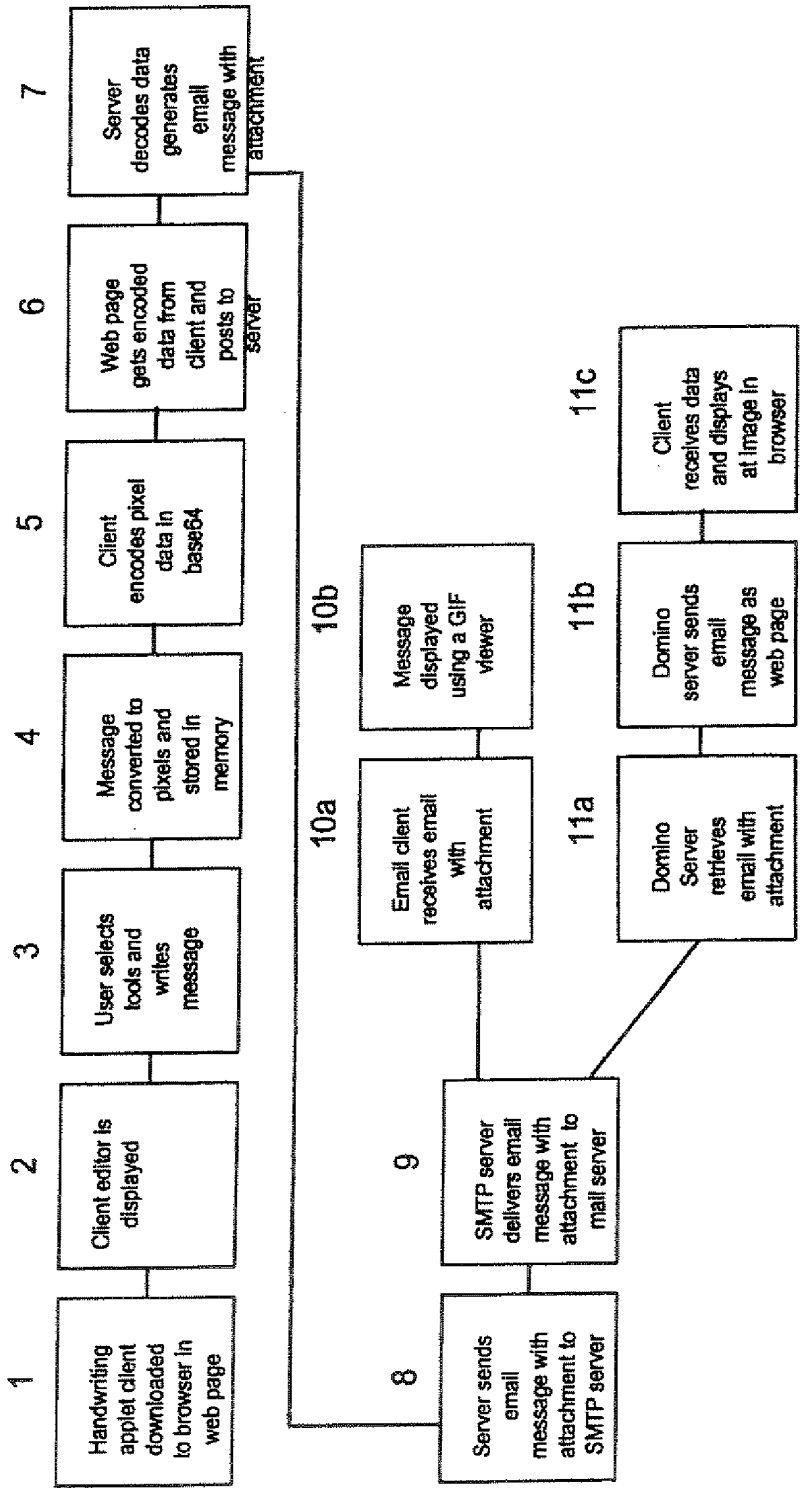


FIG. 3A
Handwriting Applet and Domino Server Version

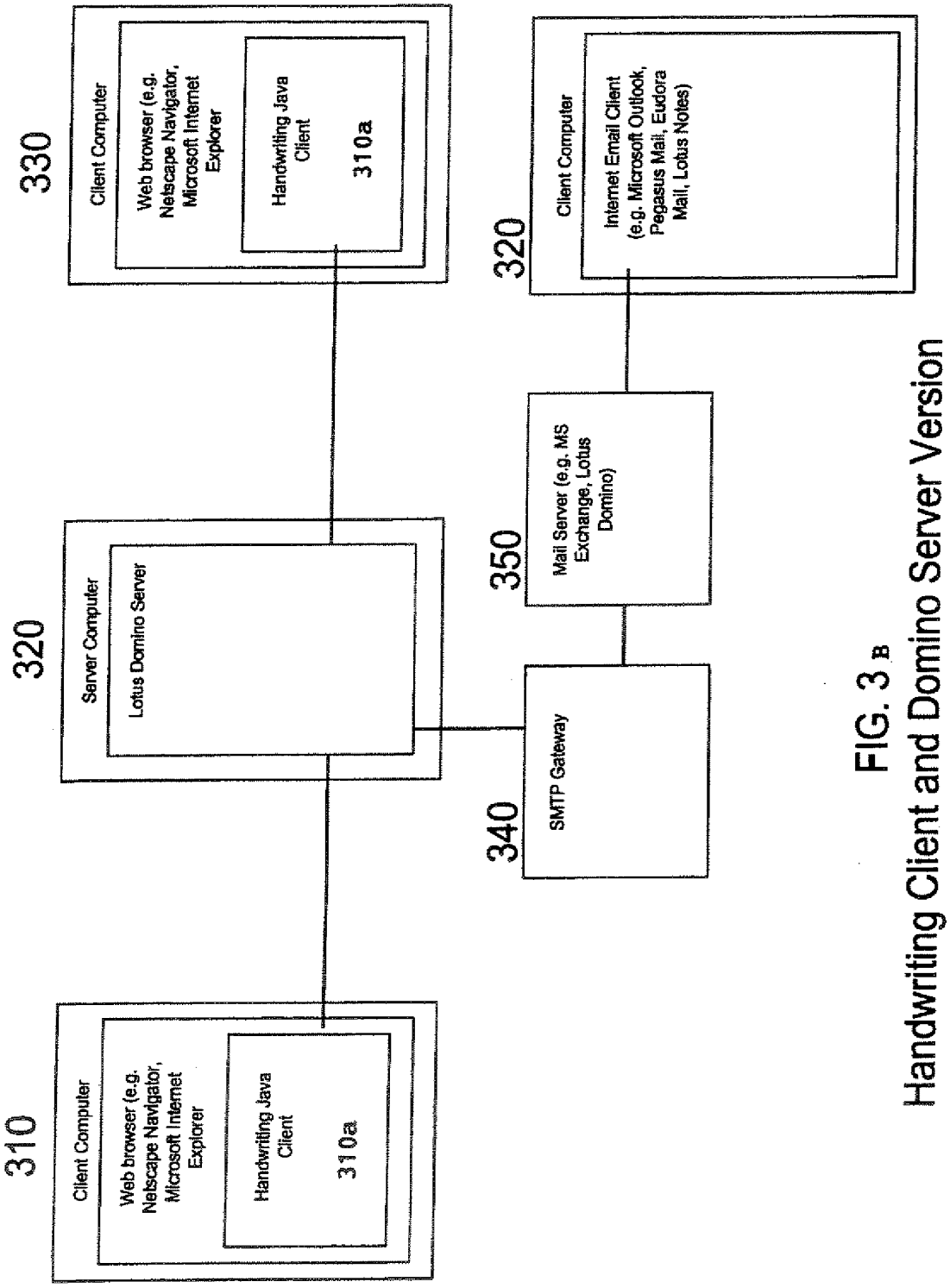


FIG. 3 B

Handwriting Client and Domino Server Version

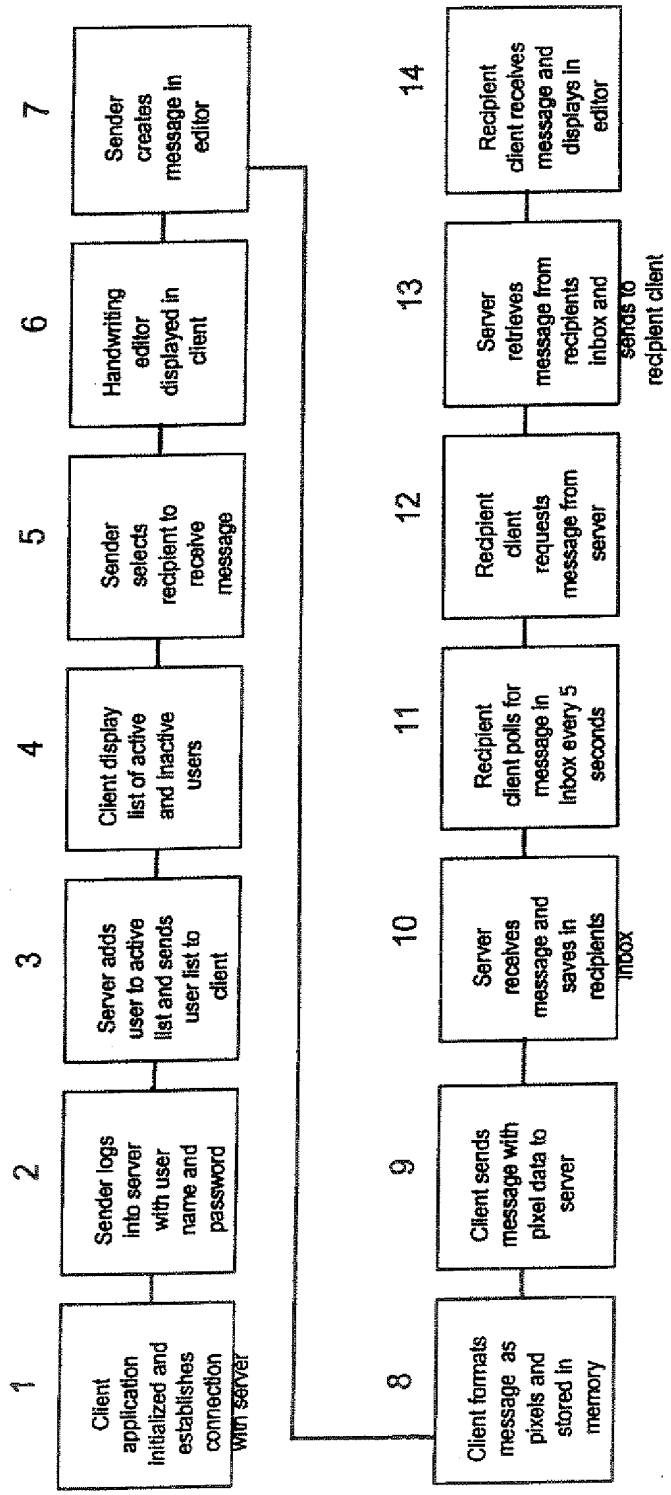


FIG. 4 A

Handwriting Applet and Real Time Server Version

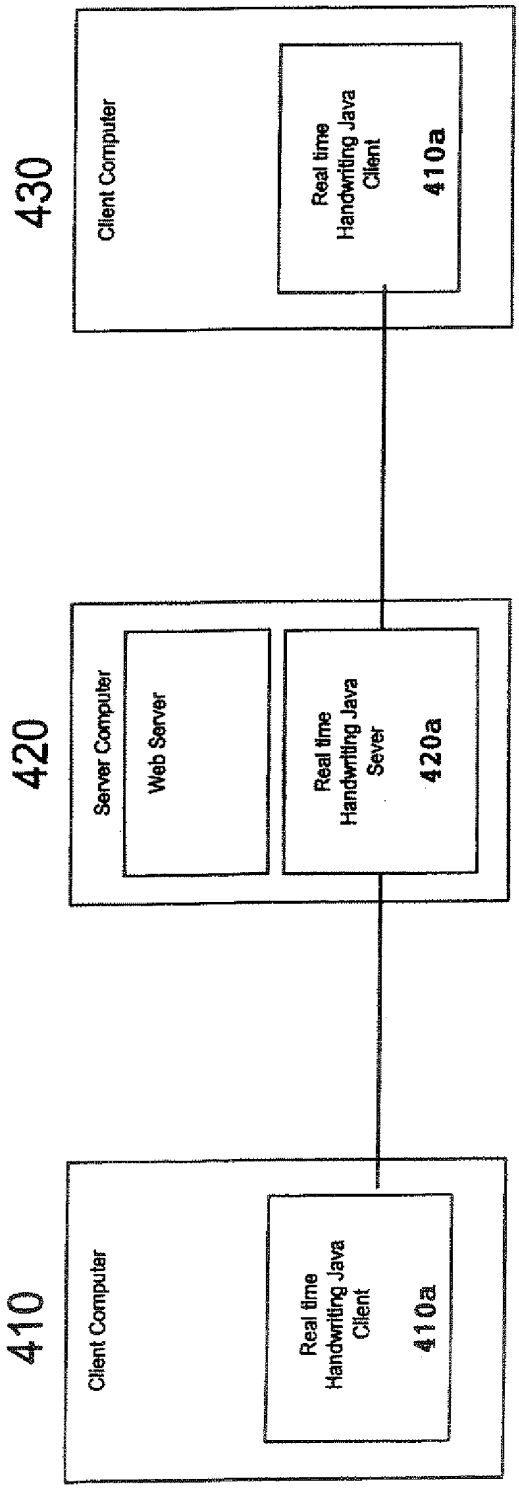


FIG. 4B
Handwriting Client and Real Time Server Version

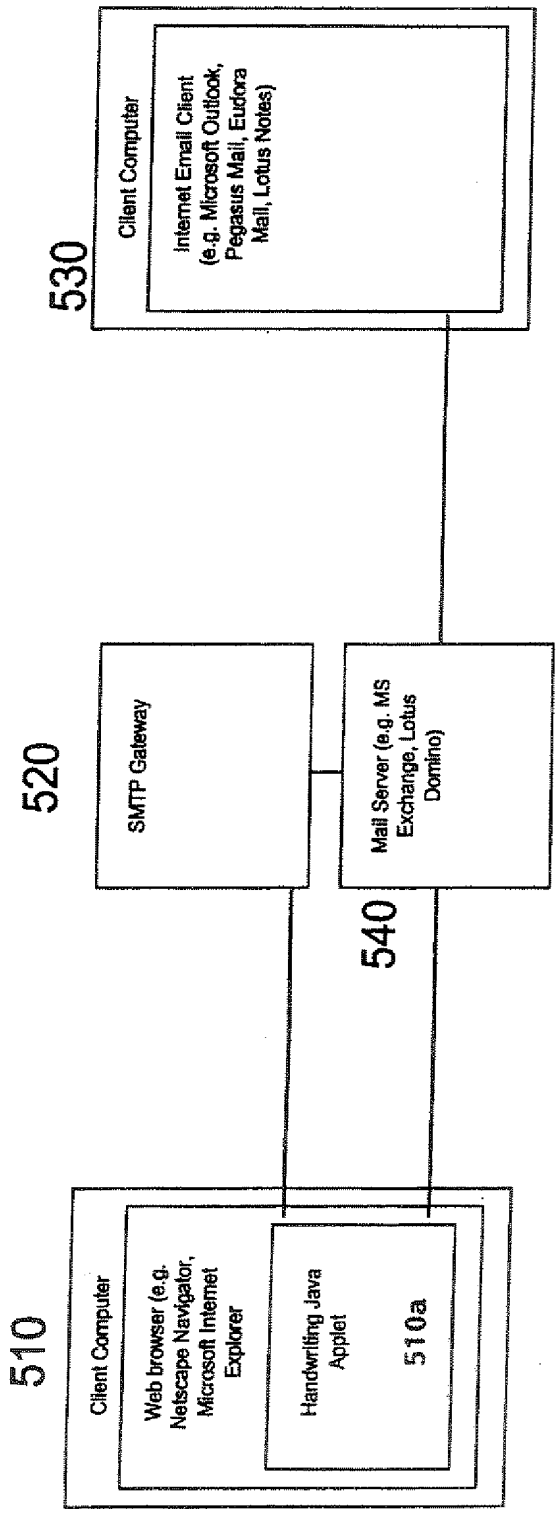


FIG. 5
Handwriting Applet and Mail Server Version

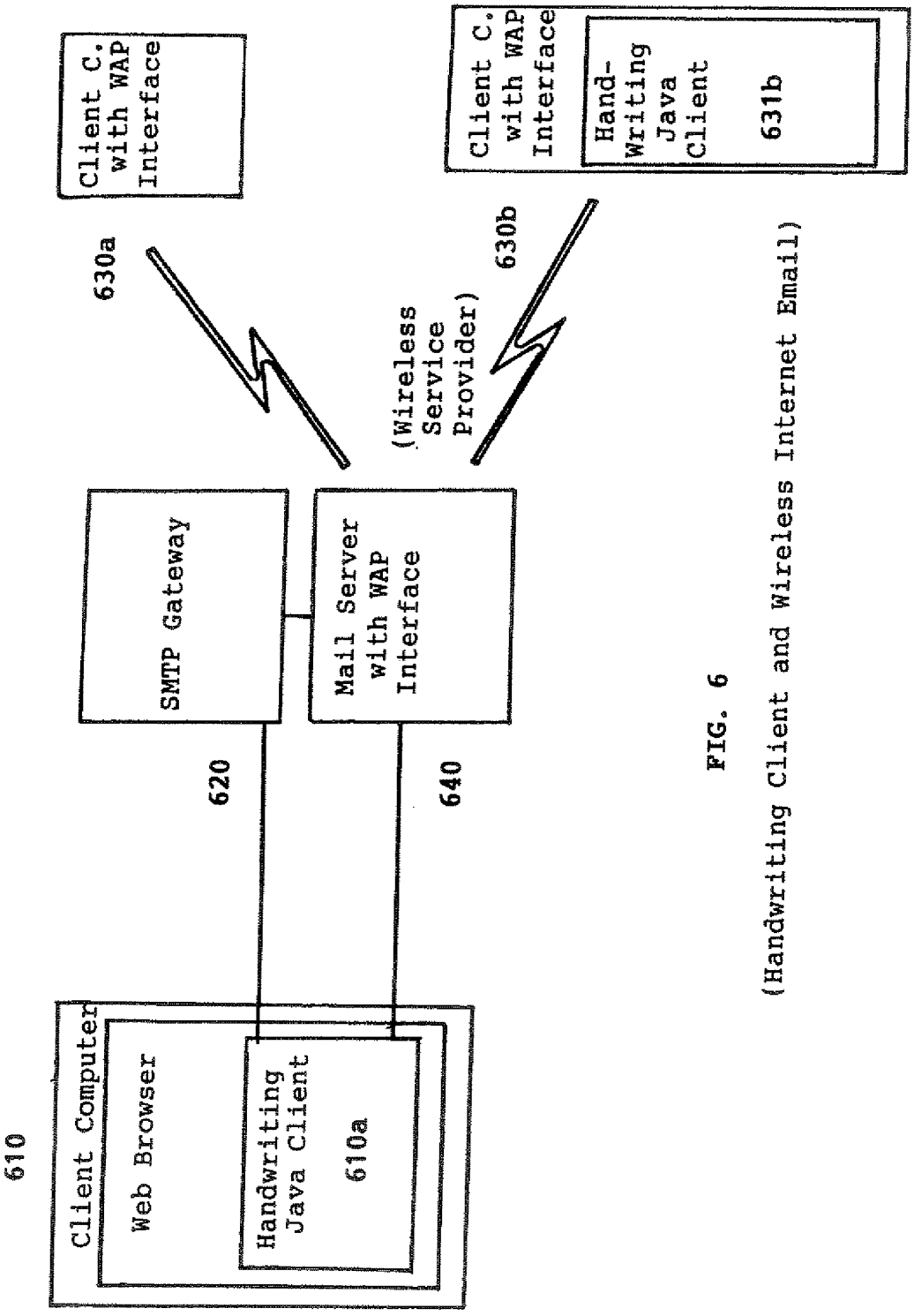


FIG. 6

(Handwriting Client and Wireless Internet Email)

FIG. 7A

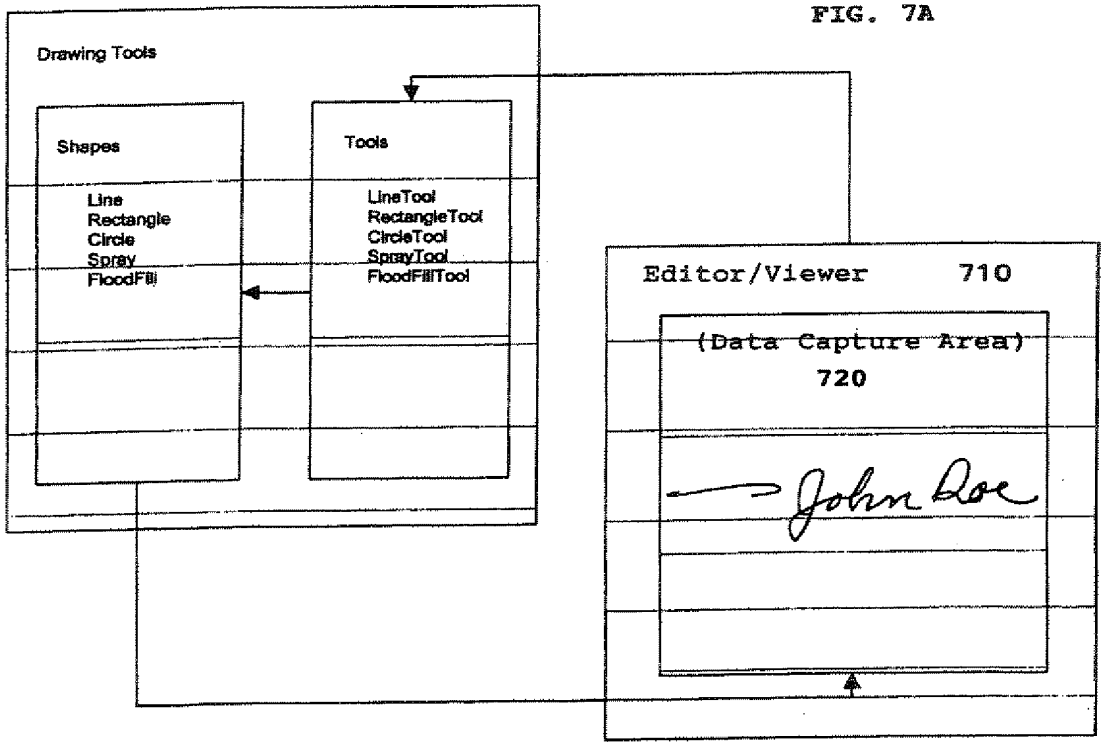
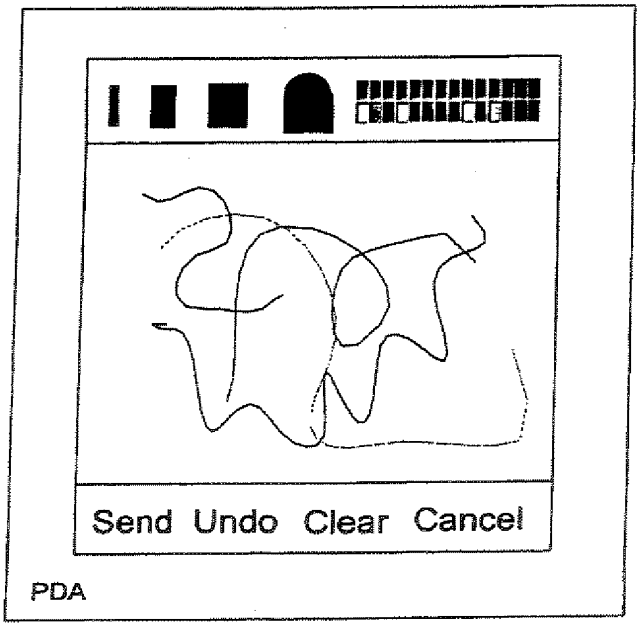

Drawing Tools
Shapes
Line
Rectangle
Circle
Spray
FloodFill
Tools
LineTool
RectangleTool
CircleTool
SprayTool
FloodFillTool
Editor/Viewer 710
(Data Capture Area)
720
John Doe

FIG. 7B


Send Undo Clear Cancel
PDA

METHOD AND SYSTEM FOR CREATING AND SENDING GRAPHICAL EMAIL

This U.S. patent application claims the priority of U.S. Provisional Application No. 60/159,636 filed on Oct. 13, 1999, entitled "Graphical Email Drawing and File Attachment System", by the same inventor.

FIELD OF THE INVENTION

This invention relates generally to the processing of handwritten content as digital data in electronic messaging, and specifically to an electronic messaging system for graphical (handwritten or handdrawn) email.

BACKGROUND OF THE INVENTION

Electronic messaging is a general method for sending and receiving communications as digital data between computers on a network. The Internet has dramatically increased electronic messaging amongst millions of users on global data networks. Many different forms of electronic messaging are being used to send and receive communications in a wide variety of forms of structured and unstructured data. Businesses make extensive use of electronic messaging to conduct business communications and transactions between trading partners. Electronic mail (or email) is a popular form of electronic messaging for communications between users. Typical email messages are composed of typed text or a combination of typed text and text or graphical files that are attached to the email message and opened with the appropriate processor or viewer. As the popularity of the Internet continues to grow worldwide, more and more people numbering in the billions are expected to use email for communications.

Recent advances in technology and standards have expanded the types and forms of devices that can connect to the Internet. In addition to dial-up and online connections between users computers and servers that provide information services and email services, many types of other devices are being connected to the Internet for communications purposes, including personal digital assistants (PDAs), text messaging pagers, digital cellphones enabled with Wireless Application Protocol (WAP), advanced digital game machines, digital set top boxes for televisions, and even CPU-controlled household appliances. Many of these devices having Internet access do not require or are not adapted to use a keyboard for inputting data. While there are other types of input devices that enable handwritten or handdrawn input, such as touch sensitive screens, stylus pads, optical pens, etc., they have not been enabled for electronic messaging and other communication functions.

Handwritten or handdrawn input can be more convenient to use than a keyboard and, in many situations, would be uniquely necessary for certain types of communication. Many written language systems, such as Japanese, Korean, Chinese, Arabic, Thai, Sanskrit, etc., use cursive or ideographic characters that are very difficult to input by an equivalent method via keyboard. For example, text input of the Japanese written language requires the use of simulated phonetic spelling methods (romanji, hiragana, and/or katakana) to select from thousands of possible kanji characters. Many mobile devices such as PDAs do not have keyboards due to their limited size and form, or would become cumbersome to use if a keyboard must be attached or if text must be entered by cursoring through displays of softkeys. Disabled or hospitalized people who have limited hand mobility may not be able to use a keyboard effectively.

Current legal and financial institutions still rely heavily on the use of handwritten signatures to validate a person's unique identity. And in many instances, people find it much easier to communicate an idea by drawing a picture, or prefer handwriting or drawing a picture as more personal or expressive communication than typing text on a keyboard.

There is thus a clear need for an electronic messaging system that allows people to communicate with their own handwriting or drawing, as contrasted to typed text. This need will continue to grow as the numbers of global users and Internet-connected devices increase. None of the current electronic messaging methods allow a user to compose, manipulate, store, send, receive, and view a handwritten or handdrawn email message.

SUMMARY OF THE INVENTION

In accordance with the present invention, an electronic messaging system, and related method, comprises a handwriting server component operable on a server computer on a network with an email host server for receiving an email message sent from a user and storing it for retrieval by a user to whom it is addressed, and a handwriting client component operable with an email client on a client computer for setting up a graphical data capture area into which a user can enter handwritten or handdrawn input through a suitable graphical input device, and for capturing the handwritten or handdrawn input as graphical data and sending it via the network to the server component for handling as an email message. The client component is also operable for setting up a graphical data viewing area for viewing the graphical data sent with an email message handled by the server component.

In another version of the invention, an electronic messaging device, and related method, comprises a handwriting messaging component operable in a web browser of a computer connected on a network for setting up a graphical data capture area into which a user can enter handwritten or handdrawn input through a suitable graphical input device, and for capturing the handwritten or handdrawn input as graphical data and sending it as an email message on the network. The handwriting messaging component can convert the graphical data to a GIF file that is attached to the email message and send the email message to a standard Internet email server. Alternatively, the handwriting messaging component can format the captured data as pixel data and send it to a handwriting server component of a server computer that can transmit it to a receiving computer enabled with a similar handwriting messaging component for retrieving the email message and viewing the pixel data as the corresponding handwritten or handdrawn image.

In the preferred embodiments, the handwriting messaging component is a Java applet downloadable to a web page for an email client of a standard web browser, or may be a Java plug-in application installed with the web browser. The graphical input device can be a touch screen, pen input device, stylus pad, or even a standard mouse. The handwriting messaging component sets up a drawing editor/viewer that allows the user to compose, manipulate, and view handwritten or handdrawn messages. The editor/viewer can include standard drawing tools such as those for line size, color, paper and border selection, circle and polygon shapes, spray paint, flood fill, color palette, undo and scrolling functions.

Other objects, features, and advantages of the present invention will be described in further detail below, with reference to the following drawings:

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1A is a diagram illustrating the connection of client computers with pen devices to an email server computer on the Internet, and FIG. 1B shows the email handling components of the client and server computers;

FIG. 2A is a process flow diagram of an SMTP server version of the graphical email system, and FIG. 2B is a schematic illustration of the network connections of this version of the graphical email system;

FIG. 3A is a process flow diagram of a Lotus™ Domino server version of the graphical email system, and FIG. 3B is a schematic illustration of the network connections of this version of the graphical email system;

FIG. 4A is a process flow diagram of a real-time messaging server version of the graphical email system, and FIG. 4B is a schematic illustration of the network connections of this version of the graphical email system;

FIG. 5 is a schematic illustration of the network connections of an Internet email server version of the graphical email system;

FIG. 6 is a schematic illustration of the network connections of a WAP-enabled cellphone or PDA version of the graphical email system; and

FIG. 7A is a schematic illustration of the user interface for the graphical data capture and drawing functions of the graphical email system; and FIG. 7B is an example of an editor/viewer interface for the graphical email system on a personal digital assistant (PDA).

DETAILED DESCRIPTION OF INVENTION

Referring to FIG. **1A**, the general system architecture of the graphical email system (and related method) of the present invention is illustrated. A plurality of client computers **110, 111**, etc., adapted for handwriting or handdrawing input are used by users to connect via a network (the Internet or any type of multi-user network) to a server computer **120**. In the context of this description, the term "computer" is used to refer to any type of data processing device which is capable of executing digitally programmed instructions. The term "client computer" refers to any computer capable of connecting to a server computer on a network and performing a function with the server computer. An example of a typical computer for use on a network is a Pentium or higher class PC with Windows operating system of Microsoft Corp., Redmond, Wash., or MacIntosh or higher class PC with MacIntosh OS operating system of Apple Computer Corp., Cupertino, Calif. However, a client computer can also be a wide range of other network-connectable computing devices such as personal digital assistants (PDAs), text messaging pagers, digital cellphones enabled with Wireless Application Protocol (WAP), advanced digital game machines, digital set top boxes for televisions, and even CPU-controlled household appliances. The term "server computer" is used to refer to any type of data processing device that is connected to a node on a network for providing services to client devices on the network.

In the present invention, the client computer **110** is what a sender or recipient uses to compose and send, and receive and view, handwritten or handdrawn email messages. The client computer preferably is of the type that can run a standard web browser which supports an email client, such as those compatible with Microsoft IE 4.x browsers, licensed by Microsoft Corp., of Bellevue, Wash., or Netscape 4.x web browsers, licensed by America Online, Inc., of Fairfax, Va. The standard browsers preferably also support the Java Virtual Machine, Version 1.2 or higher, licensed by Sun Microsystems, of Mountain View, Calif., which is the preferred platform for programming and distributing the handwriting messaging software in the present invention as Java applets or Java-based plug-ins to the browsers. The standard web browsers connect to the network using any standard protocol recognized on the network. For example, on the Internet standard web browsers use the TCP/IP protocol. Connection to the network may be made by modem over a dial-up telephone line, DSL line, cable modem, Internet access connection, or a local area network.

The handwriting or handdrawing input device can be a touch screen, pen input device, stylus pad, optical pointer, mouse, etc., which is attached to the client computer to allow the user to handwrite or handdrawn messages in a graphical data capture area of the email client of the web browser set up for that purpose. Examples of such input devices include the Wacom Graphire™ pen tablet sold by Wacom Technology Corporation, of Seattle, Wash., which attaches to the client computer via a serial or USB port. The pen device could also be integrated with a touch screen, e.g., as also offered by Wacom, or part of the computer itself, e.g., as offered with the Sharp SJ5, Copernicus and Pro Stations sold by Sharp Corporation, of Tokyo, Japan.

The server computer is a central processing server for the graphical email system. It is connected to the network to communicate with the client computers using, for example, the TCP/IP protocol on the Internet. In the preferred implementation, the server computer stores the graphical email handling software that is downloaded to the client computers. It authenticates users against a directory of authorized users and manages and tracks the state of concurrent user sessions. For sending and receiving graphical email, it communicates with the graphical email software on the client computers. When a handwriting message is composed on the client computer, the server computer receives the graphical email message and stores it in a database. When a handwriting message is to be viewed by the client computer, the server computer fetches the graphical email message from the database and sends the message to the client computer for display as a handwriting image.

Referring to FIG. **1B**, the graphical email handling components of the preferred implementation of the invention system are illustrated. The client computer **210** includes a Handwriting Messaging Client **211** which handles sending and receiving graphical email messages, a Java Virtual Machine (VM) **212** which sets up the graphical data capture area and display area for the handwriting message, and the Web Browser **213** which provides the user interface for connecting to the Internet (or other network). There are two versions of the Handwriting Messaging Client software described below, i.e., a Java applet and a Java application version. The Java applet version is used for sending and receiving handwritten email messages via a server computer's mail server functions. The Java application version of the handwriting messaging client software is installed with the users' browsers for real-time messaging between users or via a real-time Java server. The client software includes a drawing editor/viewer for composing and viewing handwritten email messages, as well as the functions to communicate with a server in a server-client configuration.

The server computer **220** includes an HTTP Server Interface **221** for connection to the Internet, a User Directory **222** for identifying email addresses of authorized users, User Message Queues **223** for delivering received messages to users, a Downloadable Software Server **224** for download-

ing the graphical email software to client computers, a Mail Server Interface **225** for handling sent and received email, a Java Virtual Machine (VM) **226** which provides the platform for interacting with the users' graphical email software, and a Handwriting Messaging Server **227** which formats email messages using the graphical data captured by the software on the client computers. There are four versions of the Handwriting Messaging Server described below, i.e., a Handwriting Java Server Version, a Domino Server Version, a Real-Time Java Server Version, and an Internet Email Server Version.

Handwriting Java Client and Handwriting Java Server Version

With reference to FIG. **2**B, this version of the system uses both handwriting client and server software components along with the usual email server functions. A Handwriting Java Client **210***a* operates in a web browser (such as Netscape Navigator or Microsoft Internet Explorer) as a Java applet on the client computer **210**. The applet **210***a* provides a drawing editor to compose and send handwritten email messages, and on the receiving end, also provides the drawing viewer to view the handwritten message. The implementation of a Java applet for the handwriting messaging function is described in further detail below. Generally, the use of a Java applet to provide a drawing application intended to run in a browser is known to those knowledgeable in this field. As one example, a Java applet used to set up a drawing editor in a browser for a "whiteboard" application run on an intranet is the SameTime™ whiteboard applet offered with Lotus™ Notes, a workgroup software suite distributed by Lotus Development Corp., of Cambridge, Mass., which is a division of IBM Corp., Armonk, N.Y.

In the present invention, a Java applet is created specifically for setting up a drawing editor/viewer operable with an email client running with a web browser for capturing, sending, receiving and viewing a handwriting or handdrawing email message. The Java applet consists of a set of modules which run the different messaging functions of the drawing editor/viewer. The data capture and sending module operates by first recognizing the handwriting input device connected to the client computer, then creating a temporary memory space for holding the input received from the input device, capturing the input signals from the input device (usually a series of coordinate data inputs representing time-sampled coordinate positions detected for the trace of the input device), converting the input signals to pixel data (screen coordinates, color, intensity), and displaying the pixel data in a display area or "panel" of the email client to show the handwriting or handdrawn image input by the user through the input device. The display allows the user sending a handwritten email message to verify what is being written, and is also the same display that allows a user receiving the handwritten email message to view the corresponding image. An example of a data capture and sending module according to the invention is illustrated in the source code listing appended hereto as Appendix I.

When the graphical email message is completed, the user addresses the message to a recipient and sends it. The Handwriting Java Client formats and sends the email message with the pixel data to the Handwriting Java Server component **220***a* on the server computer **220**, which converts the pixel data to a GIF file attachment to a standard email body. The Handwriting Java Server component **220***a* communicates with an SMTP email gateway computer **240** to send email messages using the industry-standard SMTP Internet protocol. The SMTP email gateway sends the email messages to mail servers **250**, such as an industry-standard IMAP (Internet Message Access Protocol) mail servers like MS Exchange or Lotus Domino on the Internet. Email recipients can retrieve their email from the mail servers **250** using a standard Internet email client **260**, such as Microsoft Outlook, Pegasus Mail, Eudora mail, or Lotus Notes. When the graphical email is retrieved with a standard Internet email client, the handwritten drawing is viewed as a file attachment using a GIF viewer operates with the web browser. Email recipients on client computers **230** who have the Handwriting Java Client **210***a* in their web browser can receive their handwritten email messages directly. The graphical email message is retrieved from the Handwriting Java Server component **220***a* on the server computer **220** and displayed in the Handwriting Java Client viewer as a handwritten or handdrawn image.

With reference to FIG. **2**A, the specific process steps involved with sending a handwritten email message and viewing it by the recipient are described in detail below:

1. The Handwriting Java Client software is downloaded from the Handwriting Java Server to the client computer through a web page that is displayed in a web browser.
2. The Handwriting Java Client software is initialized and establishes a connection to the Handwriting Java Server using the industry-standard TCP/IP and remote method invocation (RMI) protocols. After initialization is complete, the Handwriting Java Client software displays a drawing composition editor that is used to compose the handwritten message.
3. The handwritten message is composed by the user in a graphical data capture area set up by the drawing editor, selecting the appropriate writing and drawing tools, colors, and styles as offered in the Handwriting Java Client software.
4. While the user is drawing in the graphical data capture area, the pixel data representing the drawing is stored in local memory. When the graphical email message is completed, the user addresses the message to a recipient using Javascript fields on the web page in which the Java handwriting client is embedded.
5. When the user issues a "Send" command, the Handwriting Java Client formats the message and sends the pixel data to the Handwriting Java Server. The graphical message is still in GIF format at this time.
6. The Handwriting Java Server processes the graphical message data using standard base64 encoding. This turns the data into ASCII text that can be transmitted as standard email data packets by the Handwriting Java Server.
7. The Handwriting Java Server creates an outgoing email message that contains the encoded handwritten message as a GIF attachment.
8. The Handwriting Java Server sends the outgoing email message with GIF attachment via the SMTP (Simple Mail Transfer Protocol) gateway **240**.
9. The SMTP gateway transfers the message to an IMAP mail server based on the recipient's address. The IMAP server allows clients running it to retrieve mail from the host mail server also running the protocol, similar to POP-3, but with extended capabilities. Recipients can open the email as a standard email message with a GIF attachment (steps 10a, 10b below) or with a Handwriting Java Client applet if downloaded to their web browser (steps 11a, 11b, 11c below).

10a. The IMAP server sends the email with the handwritten message as an attached encoded GIF file to an external email address for the recipient.

10b. When the recipient opens the email containing the attachment, the message can be displayed on their computer using a GIF viewer.

11a. The IMAP server sends the email with the handwritten message as an attached encoded GIF file to an internal email address, i.e., to an address on a server computer **220** that is running the Handwriting Java Server component **220***a*.

11b. The Handwriting Java Server decodes the attached GIF file into pixel data and sends it to the Handwriting Java Client applet running in the recipient's web browser.

11c. The Handwriting Java Client receives the pixel data from the Handwriting Java Server and renders the pixel data as a handwritten or handdrawn image in the drawing editor/viewer.

Handwriting Java Client and Domino Server Version

With reference to FIG. **3**B, this version of the system uses the Handwriting Java Client **310***a* along with a Lotus™ Domino Server on the server computer **320**. As before, the Handwriting Java Client **310***a* operates in a web browser as a Java applet on the client computers **310**,**330**. The applet **310***a* provides a drawing editor/viewer to compose and view handwritten messages. For sending and receiving email internally, the applet **310***a* communicates with the Domino Server on the server computer **320**. The Domino server sends email messages among users with client computers running Java client software connected to the server's intranet. The Domino Server communicates with an SMTP email gateway computer **340** to send email messages externally using the SMTP Internet protocol. The SMTP email gateway sends the email messages to mail servers **350** on the Internet. External email recipients can retrieve their graphical email using a standard Internet email client **360**. The handwritten drawing can then be viewed as a file attachment using a GIF viewer such as a web browser.

With reference to FIG. **3**A, the process steps involved with sending a handwritten email message through a Domino Server and viewing it by the recipient are described in detail below:

1. The Handwriting Java Client software is downloaded from the Handwriting Java Server to the client computer through a web page that is displayed in a web browser.
2. The Handwriting Java Client software is initialized and establishes a connection to the handwriting Domino Server using the TCP/IP and remote method invocation (RMI) protocols. After initialization is complete, the Handwriting Java Client software displays a composition editor that is used to compose the handwritten message.
3. The handwritten message is composed by the user selecting the appropriate writing and drawing tools, colors, and styles.
4. While the user is drawing, the pixel data representing the drawing is captured in the input data. area and stored in local memory. The user addresses the email message to a recipient using Javascript fields on the web page in which the Handwriting Java Client is embedded.
5. When the "Send" command is issued, the Handwriting Java Client encodes the pixel data in base64 format.
6. The Web page along with the encoded image is posted to the Domino Server using Javascript.
7. An agent on the Domino Server decodes the image and creates an email message with an attached GIF file.
8. The Domino server sends the email message with attachment to an external recipient's address via an SMTP (Simple Mail Transfer Protocol) gateway.
9. The SMTP gateway transfers the email message to a mail server, which routes the message to the recipient's email box.

10a. an external recipient's e-mail client retrieves the email message with the GIF attachment from an Internet email server.

10b. When the user (recipient of the email) opens the email containing the GIF attachment, the handwritten message in the attachment can be displayed using a GIF viewer.

11a. If the recipient has an internal email address handled by a Domino Server, the server retrieves the email message with the GIF attachment.

11b. The Domino Server sends the email message to the client computer as a web page when the client requests the page via their web browser email client.

11c. The client's web browser email client displays the handwritten message as an image

Handwriting Java Client and Real Time Server Version

With reference to FIG. **4**B, this version of the system uses the Handwriting Java Client with a Real Time Handwriting Java Server. As before, the Handwriting Java Client **410***a* operates in a web browser as a Java applet on the client computer **410**, **430**. The applet **410***a* provides a drawing editor/viewer to compose and view handwritten messages. The applet **410***a* communicates with the Real Time Java Server component **420***a* on a server computer **420**. The receiving Handwriting Java Client is notified when an email message for that user has been sent to the Real Time Java Server, and retrieves the email message from the server. In this way, communication can take place using the Handwriting Java Client in near real-time. This version is useful for users using mobile communication devices, such as PDAs, WAP-phones, etc.

With reference to FIG. **4**A, the process steps involved with sending a handwritten message through a Real-Time Handwriting Java Server and and viewing it by the recipient are described in detail below:

1. The client computer has a downloaded version of the Handwriting Java Client software, and establishes a connection with the server computer on which the Real Time Java Handwriting Server is running.
2. The client computer identifies the user to the server by entering a user name and password.
3. The server maintains a list of registered users, and a list of currently active users. When the client logs onto the server, the server looks up the user name and password in order to authenticate that person as a registered user, then the user is added to the list of active users.
4. The client computer displays a list of active and inactive users which is downloaded from the server.
5. The user clicks on a name from the list of active users to identify the user to whom they want to send a message.
6. After the user selects a name from the list of active users, the handwriting editor is displayed in the Handwriting Java Client.
7. The user creates a message by selecting the appropriate writing and drawing tools, colors, and styles.
8. The Handwriting Java Client formats the message and stores it as pixel data until it is ready to be sent.
9. The completed message is sent to the Real Time Java Handwriting Server in pixel format.
10. The server receives the message and puts it into a repository where it can be retrieved by the user to whom it is addressed.
11. All active client computers poll the repository on the server every five seconds to see if there are any messages for them.
12. When the Handwriting Java Client on the recipient's computer discovers a message in the repository, the client computer requests the message from the server.

13. The server retrieves the message from the repository and sends it to the client computer of the recipient.

14. The recipient's client computer displays the message in the Handwriting Java Client's drawing editor/viewer.

Handwriting Java Client and Internet Email Server Version

With reference to FIG. **5**, this version of the system uses the Handwriting Java Client along with a standard Internet email mail server. In this version, the Handwriting Java Client is installed as a plug-in to the client computer's web browser and operates as described before, and there is no Handwriting Java Server component. The Handwriting Java Client **510***a* operates in a web browser as an installed Java applet on the client computer **510**. The applet **510***a* provides a drawing editor/viewer to compose and view handwritten messages. The Handwriting Java Client formats the message and stores it as pixel data until it is ready to be sent. The message is addressed using Javascript fields on the Web browser form in which the Java applet is embedded. The pixel image is converted into a GIF file and attached to the email message. The Java applet **510***a* communicates with the Mail Server computer **540** either directly or through an SMTP gateway computer **520**. The Mail Server **540** sends the email message with encapsulated GIF image directly to the recipient's client computer **530**, and the recipient views the attached GIF file using whatever GIF viewer they have available on their computer.

Handwriting Java Client and Wireless Internet Email Server Version

With reference to FIG. **6**, this version of the system uses the Handwriting Java Client along with a standard Internet email mail server providing email service to wireless client computers, such as WAP-phones and PDAs. As before, the Handwriting Java Client **610***a* operates in a web browser as an installed Java applet on the client computer **610**. The email message is formatted with the handwritten image converted into an attached GIF file. The Java applet **610***a* communicates with the Mail Server computer **640** either directly or through an SMTP gateway computer **620**. The Mail Server **640** includes a Wireless Application Protocol (WAP) interface which sends the email message with encapsulated GIF image through a Wireless Service Provider having WAP handling capability to the recipient.

The recipient's computer can be a thin client **630***a* such as a digital cellphone with a WAP interface for receiving the email message via Internet and displaying the GIF file via its mini-web browser. Alternatively, the client computer may be a more robust, mobile client computer **630***b* such as a Palm Pilots or similar type of PDA, which has the memory and CPU capacity to have a Handwriting Java Client installed with its web browser and use it for composing and sending handwriting email messages as well as viewing them. The mobile client computer can then use the Handwriting Java Client to format the handwritten message as an attached GIF file (described in the Internet Email Server version) or as pixel data sent with the email for viewing by another client computer having a Handwriting Java Client running in its web browser (as described in the Real-Time Server version).

A handwriting messaging application written for a palm-top or PDA device would currently have to be written in C or C++ because there are no current Java Virtual Machine adaptations that can be used for such devices. However, several efforts are underway to create such Java VM modules for palm-top and PDA devices. Using C/C++ to write full applications on palm-top devices has the current advantage that the security sandbox imposed on Java applets does not exist, thereby allowing a wider variety of messaging applications to be written, as long as actual implementations are kept simple (due to low CPU power and memory storage availability). The handwriting client can be kept simple by including only pen and eraser tools and different line thicknesses. Only palm-top devices with color displays would need a color palette; black and white palm-top devices would dither incoming messages to black and white while sending only two-color images. Since the client is written in C or C++, networking would be limited to standard TCP/IP communications instead of Java's RMI. For communications through a proxy, packets can be wrapped in HTTP and sent through an HTTP proxy. If a handwriting server component is used with the palm-top devices, it would remain largely the same as described above, except that it would handle only standard TCP/IP communications, and would add the ability to receive messaging information wrapped in HTTP packets from behind a firewall.

The functions of the module of the client component which converts and sends the handwritten message for handling as an email message depends upon the configuration of the system. If the system is configured with a Lotus Domino server on a Java VM platform, then the captured handwriting data is sent as a message to the Domino server in the form of a stream of pixel data which is converted by the server to a Graphics Interface Format (GIF) file and appended with an email header to form an email message handled by the server's email service. If the system is configured with a standard type of Internet email server, then the captured handwriting data can be converted at the client computer to a GIF file and sent as an email message to the Internet email server. If the system is configured for real time messaging between client devices, the client device can send the handwritten message as a GIF file appended to standard email, or send it as pixel data to a real-time messaging server which provides real-time messaging service between client devices.

In FIG. 7A, the user interface for the drawing editor/viewer of the Handwriting Java Client is illustrated. For composing a handwritten message, the editor/viewer **710** has a graphical data capture area **720** in which handwritten input can be entered with a touch pen or on a stylus pad and captured as pixel data. The editor/viewer **710** can offer a suite of standard types of drawing tools such as making line, circle, or polygon shapes and spraying and filling image areas. The graphical data capture area **720** is also the graphical image viewing area for email received with an attached GIF file or pixel data. In FIG. 7B, a typical layout for a PDA of the editor/viewer interface with drawing tools and color palette is illustrated.

It is understood that many other modifications and variations may be devised given the above description of the principles of the invention. It is intended that all such modifications and variations be considered as within the spirit and scope of this invention, as defined in the following claims.

APPENDIX I

GRAPHICS DATA CAPTURE & SENDING MODULE

```
import java.io.*;
import java.util.*;
import javax.mail.*;
import javax.activation.*;
```

APPENDIX I-continued

GRAPHICS DATA CAPTURE & SENDING MODULE

```
import javax.mail.internet.*;
/**
 * StarMailAgent is called as the form action for a starmail submission form
 * (see, for example, pages/starmailmessage)
 * Note that it is not a web query save agent!
 */
public class StarMailAgent extends HttpAgentBase
{
    protected Session           m_mailSession;
    protected String            m_strHost;
    protected String            m_strSMTP;
    protected String            m_strUser;
    protected String            m_strPassword;
    protected String            m_strAdmin;
    protected boolean           m_bFiltered;
    /**
     * Main entry point for this agent
     *
********** THIS IS THE MAIN EMAIL DELIVERY CODE **********
     */
    public void doPost(HttpAgentRequest _req, HttpAgentResponse _res) {
        // Get mail parameters
        String protocol = "imap";
        m_strHost     = _req.getServerName( );
        m_strSMTP     = _req.getParameter("SMTPServer");
        m_strUser     = _req.getParameter("From");
        m_strPassword = _req.getParameter("Password");
        m_strAdmin    = _req.getParameter("Admin");
        m_bFiltered   = _req.getParameter("Filtered").equals("Yes");
        // Establish mail properties and get a session
        Properties props = new Properties( );
        props.put("mail.imap.host", m_strHost);
        props.put("mail.smtp.host", m_strSMTP);
        m_mailSession = Session.getDefaultInstance(props, null);
        // Get mail params
        String strTo    = _req.getParameter("SendTo");
        String strSubj  = _req.getParameter("Subject");
        String strBody  = _req.getParameter("Body");
        String strImage = _req.getParameter("Image");
        // create and send the message
        try {
            Message msg;
            if (strImage == null) {
                // Create and send message, and append to the outbox
                msg = createMessage(strTo, strSubj, strBody);
            } else {
                msg = createImageMessage(strTo, strSubj, strBody, strImage);
            }
            Transport.send(msg);
            if (_req.getParameter("Save").equals("Yes")) {
                appendMessage(msg, "outbox");
            }
        } catch (MessagingException e) {
            _res.setContentType("text/plain");
            PrintWriter out = _res.getWriter( );
            out.println("Error!");
            out.println(m_strHost);
            e.printStackTrace(out);
        }
        // Redirect to inbox
        String path = _req.getPathInfo( );
        String shortpath = path.substring(0, path.indexOf(".nsf"));
        shortpath = shortpath.substring(0, path.indexOf("/") + 1);
            _res.sendRedirect(shortpath + _req.getParameter("MailDB") +
//
"/$Inbox");
            _res.sendRedirect(shortpath + _req.getParameter("url"));
    }
    /**
     * Given some text, create a mail message out of it suitable for mailing
     * @param _to
     * @param _subj
     * @param _text The message body text
     */
    protected Message createMessage(String _to, String _subj, String _text)
throws MessagingException {
        Message msg = new MimeMessage(m_mailSession);
```

APPENDIX I-continued

GRAPHICS DATA CAPTURE & SENDING MODULE

```
        InternetAddress fromAddr = createAddress (m_strUser);
        msg.setFrom(fromAddr);
        InternetAddress[ ] recip = new InternetAddress[1];
        String subject;
        if (m_bFiltered) {
            recip[0] = createAddress(m_strAdmin);
            subject = _subj + "#1#" + _to;
        } else {
            recip[0] = createAddress(_to);
            subject = _subj;
        }
        msg.setRecipients(Message.RecipientType.TO, recip);
        msg.setSubject(subject);
        msg.setContent(_text, "text/plain");
        return msg;
    }
    /**
     * Given some text, create a mail message out of it suitable for mailing
     * @param _to
     * @param _subj
     * @param _text The message body text
     * @param _image The image data, encoded as Base64
     */
    protected Message createImageMessage(String _to, String _subj, String _text,
String _image) throws MessagingException {
        Message msg = new MimeMessage(m_mailSession);
        InternetAddress fromAddr = createAddress (m_strUser);
        msg.setFrom(fromAddr);
        InternetAddress[ ] recip = new InternetAddress[1];
        String subject;
        if (m_bFiltered) {
            recip[0] = createAddress(m_strAdmin);
            subject = _subj + "#1#" + _to;
        } else {
            recip[0] = createAddress(_to);
            subject = _subj;
        }
        msg.setRecipients(Message.RecipientType.TO, recip);
        msg.setSubject(subject);
        // Add the text part
        Multipart mp = new MimeMultipart( );
        MimeBodyPart body1 = new MimeBodyPart( );
        body1.setText(_text);
        mp.addBodyPart(body1);
        // Add the attachment
        MimeBodyPart body2 = new MimeBodyPart( );
        byte[ ] data = Base64Decoder.decode(_image.toCharArray( ));
        body2.setDataHandler(new DataHandler(data, "image/gif"));
        body2.setFileName("StarMail.gif");
        mp.addBodyPart(body2);
        msg.setContent(mp);
        return msg;
    }
    /**
     * Create an internet address from this string. Basically searches for "@"
and appends
     * "@hostname" if not found
     */
    protected InternetAddress createAddress(String _addr) throws
AddressException {
        if (_addr.indexOf("@") == -1)
            _addr += "@" + m_strHost;
        return new InternetAddress (_addr);
    }
    /**
     * Append the message to the given folder
     * @param _msg The message to append
     * @param _folder The folder to append the message to
     */
    protected void appendMessage(Message _msg, String _folder) throws
MessagingException{
        // Get a Store object
        Store store = m_mailSession.getStore("imap");
        store.connect(m_strHost, m_strUser, m_strPassword);
        // Open folder (or create it if it doesn't exist)
        Folder dfolder = store.getFolder(_folder);
        if (!dfolder.exists ( )) dfolder.create(Folder.HOLDS_MESSAGES);
```

APPENDIX I-continued

GRAPHICS DATA CAPTURE & SENDING MODULE

```
        Message[ ] msgs= { _msg };
        dfolder.appendMessages(msgs);
        dfolder.close(false);
        store.close( );
    }
}
```

I claim:

1. An electronic messaging system comprising:

(a) a server component operable on a server computer on a network with an email host server for receiving an email message sent from a user and storing it for retrieval by a user to whom it is addressed,

(b) a remote client computer connectable to the server computer through an online data connection to the network, and an email client software operable on the remote client computer for setting up an email client interface for the user to set up and send email to a recipient via the email host server on the server computer; and

(c) a client component operable with the email client on the client computer connected to the network for setting up a graphical data capture area in the client computers email client interface, said client component also including a graphical input device which is operatively coupled to the graphical data capture area set up in the email client interface for allowing the user to enter handwritten or handdrawn input through the graphical input device, and for capturing the handwritten or handdrawn input as graphical data through the email client and sending it via the network to the server component for handling as an email message.

2. An electronic messaging system according to claim 1, wherein the client component is operable for setting up a graphical data viewing area in the client computer's email client interface for viewing a handwritten or handdrawn email message received from the email host server of the server computer.

3. An electronic messaging system according to claim 1, wherein the client component is a Java applet downloadable to the client computer's email client interface through a standard web browser on the client computer.

4. An electronic messaging system according to claim 1, wherein the client component is a Java applet installed in the client computer's email client interface in a standard web browser on the client computer.

5. An electronic messaging system according to claim 1, wherein the client component captures the graphical data as pixel data and sends it with the email message to the server component, and the server component encodes the pixel data and formats it as a graphics file for attachment to the email message.

6. An electronic messaging system according to claim 5, wherein the server component is a handwriting Java server operating on the server computer and sends the email message with pixel data to a client computer having a similar client component for viewing the pixel data as a corresponding handwritten or handdrawn image.

7. An electronic messaging system according to claim 5, wherein the server component is a handwriting Java server operating on the server computer and converts the pixel data to a graphics file that is attached to the email message and sends it to an external SMTP gateway or Internet mail server.

8. An electronic messaging system according to claim 1, wherein the client component captures the graphical data and converts it to a graphics file that is sent with the email message to the server component, and the server component handles the email message as standard email with an attached graphics file.

9. An electronic messaging system according to claim 8, wherein the server component is a handwriting Java server operating on the server computer and sends the email message with attached graphics file to a client computer having a similar client component for viewing the graphics file as a corresponding handwritten or handdrawn image.

10. An electronic messaging system according to claim 8, wherein the server component is a handwriting Java server operating on the server computer and sends the email message with attached graphics file to an external SMTP gateway or Internet mail server.

11. An electronic messaging system according to claim 1, wherein the client component captures the graphical data as pixel data and encodes it as a message for sending to the server component, and the server component formats the message as an email message with an attached graphics file.

12. An electronic messaging system according to claim 1, wherein the client component captures the graphical data as pixel data and sends it with the email message to the server component, and the server component sends the email message with the pixel data to a client computer having a similar client component for viewing the pixel data as a corresponding handwritten or handdrawn image.

13. An electronic messaging method comprising:

(a) providing a graphical data capture area in an email client interface operable on a client computer having an online connection to a network;

(b) providing a graphical input device operatively coupled to the graphical data capture area set up in the email client interface;

(c) composing an handwritten or handdrawn email message in the graphical data capture area through the graphical input device, and capturing the handwritten or handdrawn input as graphical data through the email client and sending it as an email message via the network to a server component operable on a server computer; and

(d) receiving the email message via the server component and storing it for retrieval by a user to whom it is addressed.

14. An electronic messaging device comprising:

a handwriting messaging component operable in an email client interface of a computer connected on a network, wherein said handwriting messaging component sets up a graphical data capture area in the email client interface into which a user can enter handwritten or handdrawn input,

a graphical input device which is operatively coupled to the graphical data capture area set up in the email client interface, and

wherein said handwriting messaging component captures the handwritten or handdrawn input as graphical data and sends it as an email message on the network.

15. An electronic messaging device according to claim 14, wherein the handwriting messaging component converts the graphical data to a graphics file that is attached to the email message.

16. An electronic messaging device according to claim 14, wherein the handwriting messaging component formats the graphical data as pixel data and send it with the email message.

17. An electronic messaging device according to claim 14, wherein the handwriting messaging component is operable for setting up a graphical data viewing area for viewing graphical data sent with an email message as a corresponding graphical image.

18. An electronic messaging device according to claim 14, wherein the handwriting messaging component is operable on a personal digital assistant or palm-top device for receiving graphical email via a wireless connection on the network and viewing the graphical data sent with an email message as a corresponding graphical image.

19. An electronic messaging device according to claim 14, wherein the handwriting messaging component sets up the graphical data capture area through a Java applet operable with an email client installed on the device.

20. A method of electronic messaging comprising:

providing a handwriting messaging component operable with an email client interface on a device connected to a network;

setting up via the handwriting messaging component a graphical data capture area in the email client interface into which a user can enter handwritten or handdrawn input through a suitable graphical input device;

providing a graphical input device which is operatively coupled to the graphical data capture area set up in the email client interface; and

capturing the handwritten or handdrawn input as graphical data through the email client and sending it as an email message on the network.

* * * * *

US006829478B1

(12) **United States Patent**
Layton et al.

(10) **Patent No.: US 6,829,478 B1**
(45) **Date of Patent: Dec. 7, 2004**

(54) **INFORMATION MANAGEMENT NETWORK FOR AUTOMATED DELIVERY OF ALARM NOTIFICATIONS AND OTHER INFORMATION**

(76) Inventors: **Pamela G. Layton**, 26 Longmeadow Dr., Westwood, MA (US) 02090; **Keith D. Crawford**, 67 Tanglewood Rd., Newton, MA (US) 02459; **Jeffrey A. Gadboys**, 3715 Veylon Dr., Gulf Breeze, FL (US) 32501; **Jack H. Jacobs**, 101 Oaks Rd., Millington, NJ (US) 07946

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 746 days.

(21) Appl. No.: **09/714,841**

(22) Filed: **Nov. 16, 2000**

Related U.S. Application Data

(60) Provisional application No. 60/166,585, filed on Nov. 19, 1999, and provisional application No. 60/232,340, filed on Sep. 14, 2000.

(51) **Int. Cl.**[7] **H04Q 7/20**

(52) **U.S. Cl.** **455/428**; 455/414; 455/420; 370/242; 370/244

(58) **Field of Search** 455/426.2, 428, 455/426.1, 418, 419, 420, 432, 404.1, 414, 424; 370/244, 242, 243

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,201,067	A	4/1993	Grube et al.	455/89
5,329,578	A	7/1994	Brennan	379/67
5,604,791	A	2/1997	Lee	379/67
5,745,849	A	4/1998	Britton	455/404
5,752,976	A	5/1998	Duffin et al.	607/32
5,802,467	A	9/1998	Salazar et al.	455/420
5,809,118	A	9/1998	Carmello et al.	379/102.02
5,827,180	A	10/1998	Goodman	600/300
5,845,207	A	12/1998	Amin	455/414
5,897,493	A	4/1999	Brown	600/300
5,923,731	A	7/1999	McClure	349/33
5,946,386	A	8/1999	Rogers	379/265
5,957,854	A	9/1999	Besson	600/509
5,978,688	A	11/1999	Mullins et al.	455/557
6,125,282	A	9/2000	Urabe	455/552
6,131,040	A	10/2000	Knuutila et al.	455/550
6,223,030	B1	4/2001	Van Den Heuvel	455/422
6,285,868	B1 *	9/2001	LaDue	455/410
6,411,802	B1 *	6/2002	Cardina et al.	455/424
6,473,407	B1 *	10/2002	Ditmer et al.	370/252
6,473,411	B1 *	10/2002	Kumaki et al.	370/331
6,587,457	B1 *	7/2003	Mikkonen	370/356
6,687,222	B1 *	2/2004	Albert et al.	370/230

OTHER PUBLICATIONS

Bigioi et al., "Transparent, Dynamically Configurable RF Network Suitable for Home Automation Applications," *IEEE Transactions on Consumer Electronics*, vol. 45, No. 3, pp. 474–480 (Aug. 1999).

Digital Security Controls, Ltd., datasheet on AFT–100 Glass Break Detector (3 pp. Nov. 2000).

Digital Security Controls, Ltd., datasheet on WLS906 Photoelectric Smoke Alarm (3 pp. Nov. 2000).

Digital Security Controls, Ltd., datasheet on WLS908 Panic Pendant, (2 pp. Nov. 2000).

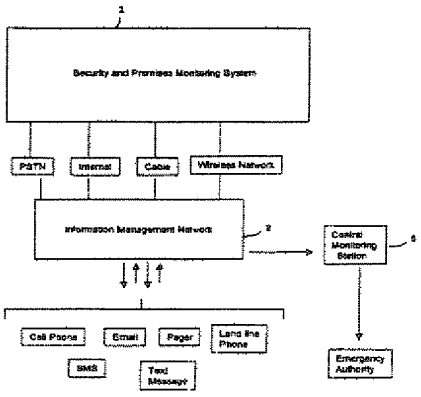
(List continued on next page.)

Primary Examiner—Cong Van Tran
(74) *Attorney, Agent, or Firm*—Burns & Levinson LLP; Frederick C. Williams; Yan Lan

(57) **ABSTRACT**

A remote Information Management Network routing system located either at an independent hosting facility or at a central station monitoring facility that receives event and alert information from a security or premise monitoring system and sequentially transmits interactive notifications about the event and alert information to wired and wireless devices specified in a user profile within the Information Management Network.

18 Claims, 4 Drawing Sheets



OTHER PUBLICATIONS

ITI Technologies, "About ITI Technologies" and datasheets on models 60–460–319.5, 60–652–95, 60–742–95R, 60–744–95 (Nov. 2000, North St. Paul, MN).
Linear Corp., "About Us " (3 pp., 2000) and "DXS Supervised Transmitters" (1 p., 2000).
Linear Corp., DXS–31 Supervised Door/Window Sensor (1 p., Carlsbad, CA, USA, © 1998).
Linear Corp., DXS–54 Supervised Passive Infrared Motion Detector (1 p., © 1998).
Linear Corp., DXS–72 Supervised Photoelectrnic Smoke Detector (1 p., © 2001).
Linear Corp., DXT–91 Glass Break (1 p., © 1998).
Microchip, Inc. webpage on PIC16C77 alarm processor (updated Sep. 26, 2000, Chandler, AZ, USA).
Motorola, Inc. datasheet on MC68HC05 telephone processor (Schaumburg, IL, Nov. 1, 2000).
Motorola, Inc., datasheet on MC13145 receiver (Schaumburg, IL, Nov. 1, 2000).
Motorola, Inc. datasheet on MC13146 transmitter (Schaumburg, IL, Nov. 1, 2000).

* cited by examiner

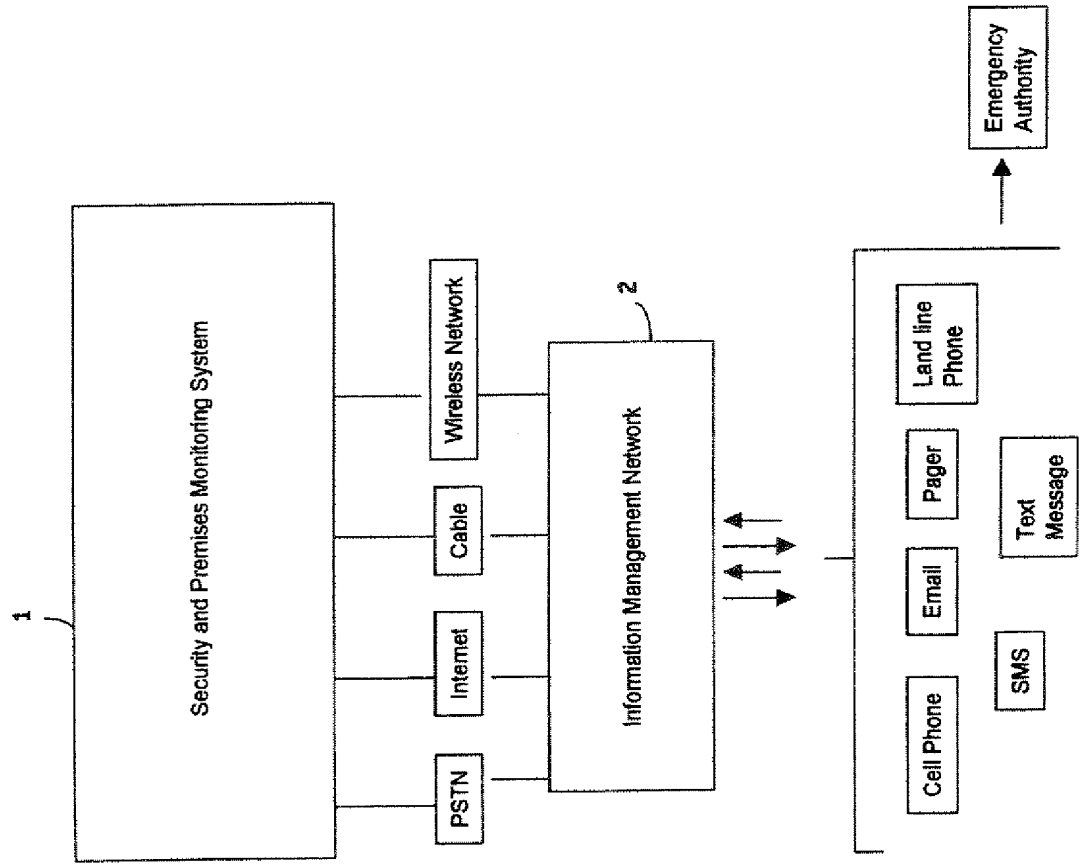

1
Security and Premises Monitoring System
Wireless Network
Cable
Internet
PSTN
2
Information Management Network
Land line Phone
Pager
Email
Text Message
SMS
Cell Phone
Emergency Authority

Figure 1.

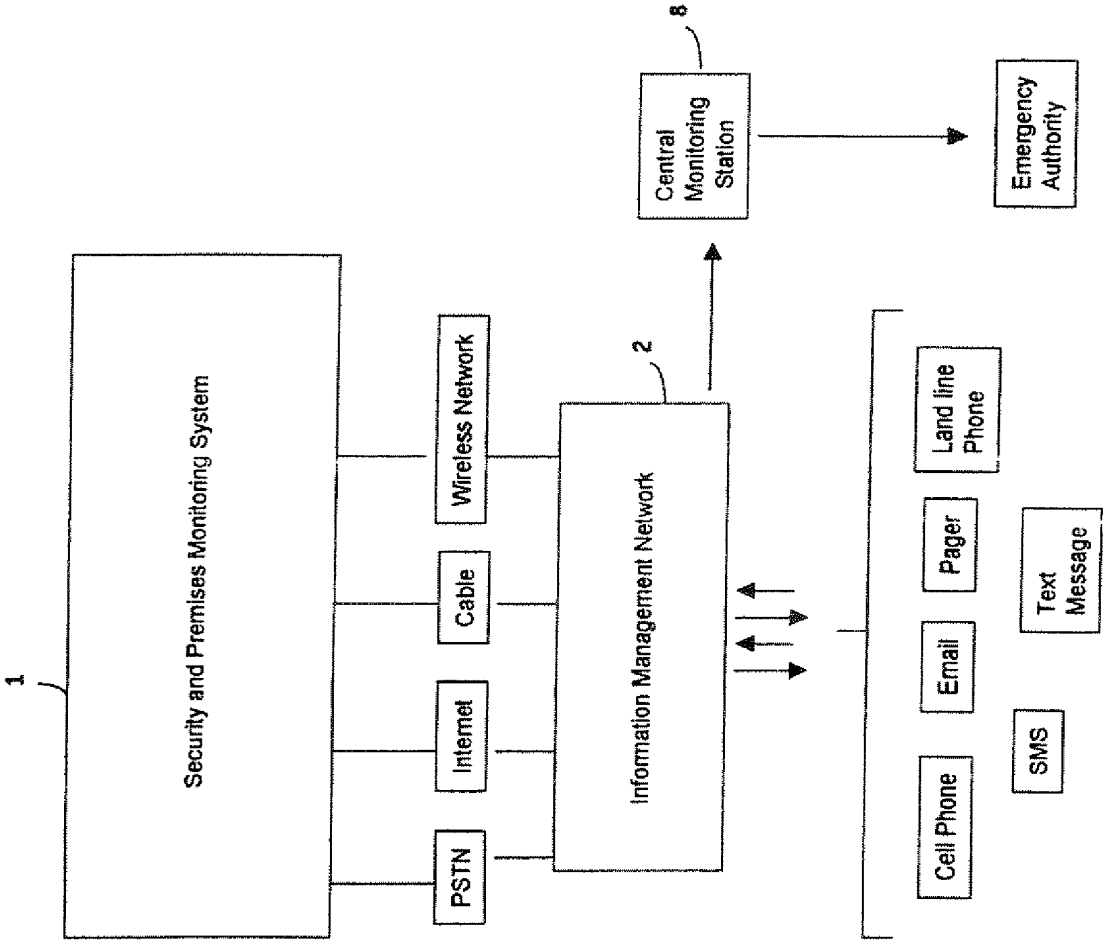

1
Security and Premises Monitoring System
Wireless Network
Cable
Internet
PSTN
2
Information Management Network
8
Central Monitoring Station
Emergency Authority
Land line Phone
Pager
Text Message
Email
SMS
Cell Phone

Figure 2.

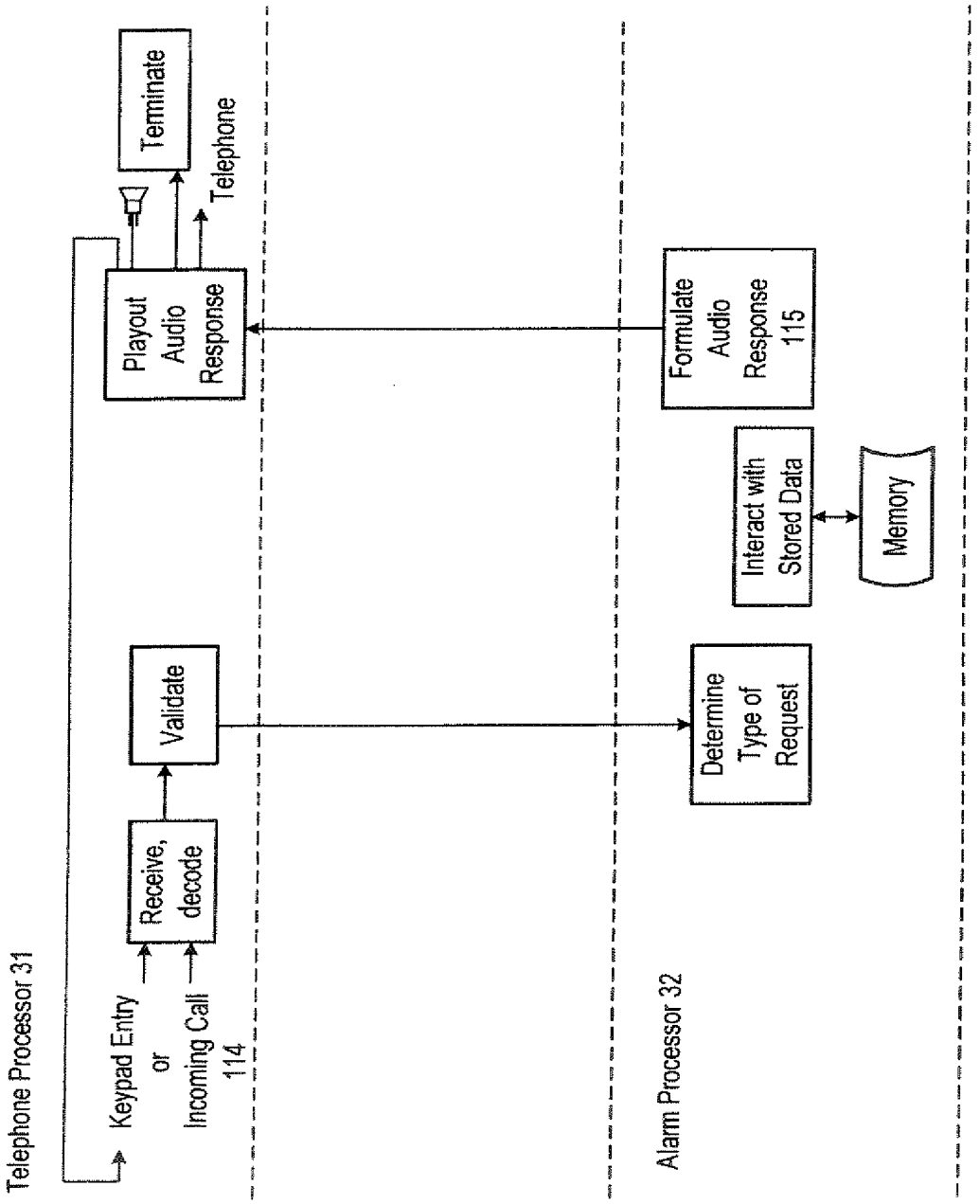

Telephone Processor 31
Keypad Entry or Incoming Call 114
Receive, decode
Validate
Playout Audio Response
Terminate
Telephone
Alarm Processor 32
Determine Type of Request
Formulate Audio Response 115
Interact with Stored Data
Memory

Fig. 3

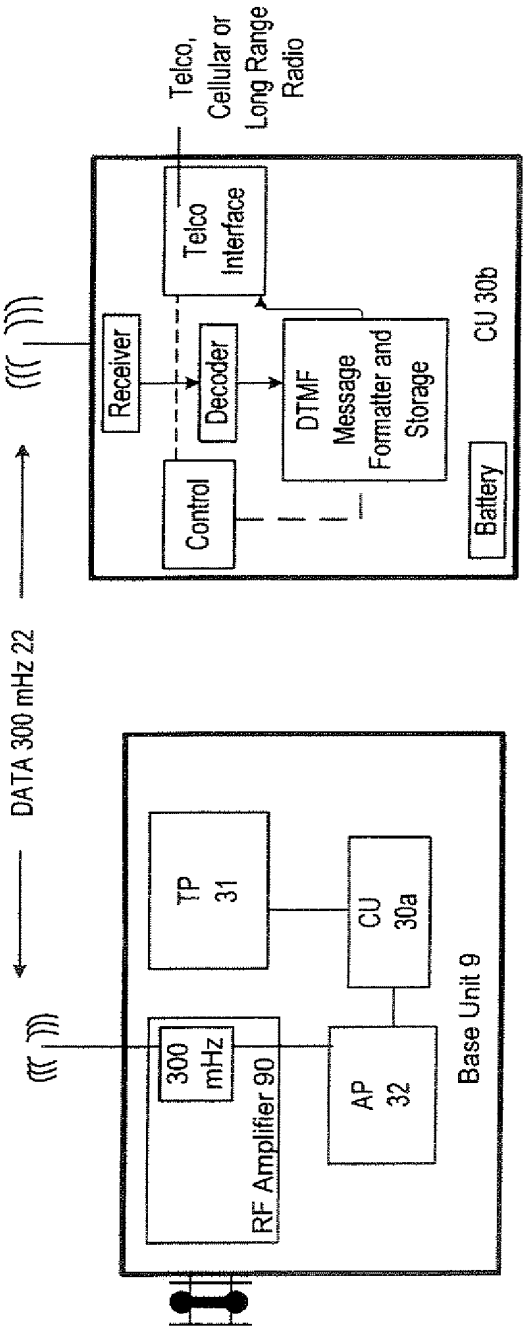

Telco, Cellular or Long Range Radio
Telco Interface
Receiver
Decoder
DTMF Message Formatter and Storage
CU 30b
Control
Battery
DATA 300 mHz 22
TP 31
CU 30a
300 mHz
RF Amplifier 90
AP 32
Base Unit 9

Fig. 4a

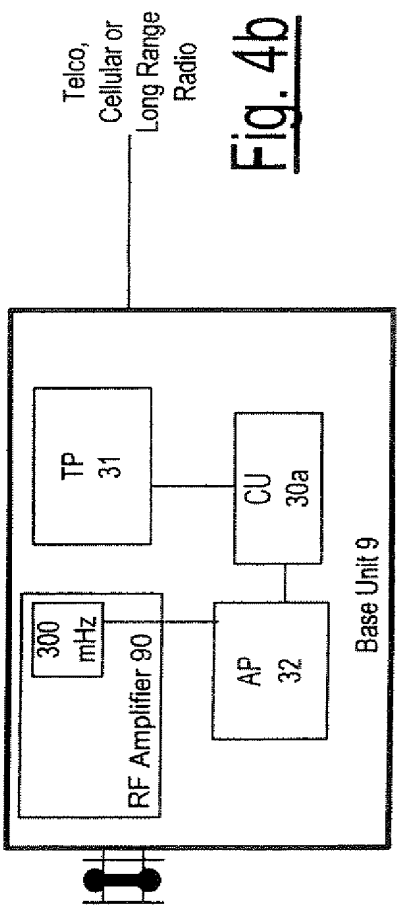

Telco, Cellular or Long Range Radio
TP 31
CU 30a
300 mHz
RF Amplifier 90
AP 32
Base Unit 9

Fig. 4b

INFORMATION MANAGEMENT NETWORK FOR AUTOMATED DELIVERY OF ALARM NOTIFICATIONS AND OTHER INFORMATION

PRIORITY

This application claims priority from U.S. Provisional Applications Ser. No. 60/166,585, filed Nov. 19, 1999, and Ser. No. 60/232,340, filed Sep. 14, 2000, and incorporates both by reference herein as though fully set forth herein.

FIELD OF THE INVENTION

This invention relates generally to security and monitoring systems for both residential as well as business and industrial use. It relates more particularly to security and monitoring systems that operate over wired or wireless networks. Even more particularly, it relates to security and information systems that use condition sensors connected by a network that facilitates remote monitoring, notification, and interaction.

BACKGROUND OF THE INVENTION

Existing premises security monitoring systems are usually connected to central monitoring stations via the public switched telephone network (PSTN) or a by a commercial wireless network. In the event of a system alert, current monitoring center procedures provide the customer with an alarm verification call, notification to the local police or fire authorities, and notification to a number of designated contact numbers. Although only 20% of the households in this country have monitored security systems, false-alarm police dispatches account for 98% of police dispatches nationwide. Such false alarm events typically cost municipalities nationwide over $1.5 billion per year. As a result of the high incidence of false alarms plaguing the industry, it is not uncommon for the police to take as long as an hour to reach the premises where an alarm has been activated.

Further, when an alarm system is violated, the siren only sounds for a period of up to five minutes. Should the homeowner return to the premises before the police arrive and after the alarm ceases, the safety of that individual is seriously compromised.

In the residential security system industry today, upon the receipt of an alarm transmission from a security or premises monitoring system, the dispatcher of the central station monitoring facility calls the premises to verify whether the emergency event is valid. If there is no answer or if it is otherwise deemed necessary, the dispatcher notifies the appropriate authority for emergency dispatch. At the time of emergency notification, the dispatcher at the central station monitoring facility is limited to the information transmitted from the base unit in the premises. The dispatcher does not have access to real-time information about the situation that could influence his decision as to whether to notify the emergency authority.

Furthermore, the calls made to the customer contacts after the authorities are dispatched are most typically not given priority by the central station monitoring facilities and are only made to the customer contacts when emergency calls and dispatches for other customers are not being made. Therefore, it is not uncommon for the contacts listed in the customer file to be notified about the alarm so long after the incident that notification is useless.

When the central station monitoring facility calls the premises to verify the alarm event, if the event notification is not cancelled, the dispatcher immediately notifies the emergency authorities for dispatch to the premises in question. If the homeowner is not at home at the time of the alarm event, the homeowner's knowledge of the premises, hardware and authorized users is not available to influence or control the action taken by the central station monitoring facility at the time of alarm signal transmission. And, it is only after the emergency authorities have been dispatched that the dispatcher of the central station monitoring facility attempts to notify the other contacts listed in the customer's file.

Current systems also allow customers limited or no opportunities to alter contact numbers in their profiles or to be contacted via the growing variety of communication devices available to the public (e.g., fax, e-mail, pager, Personal Digital Assistant (PDA), text messaging device). It is therefore generally uncommon for the contact numbers stored in the customer's contact list to be up-to-date due to the cumbersome process required to update a contact list.

These factors seriously compromise the safety of the owner of the premises, who, if not on premises at the time of the alarm event, may not receive information about the alarm notification prior to entering the premises while an intruder is still present. The above factors also contribute to the high incidence of false alarm dispatches in this country. If the owner of the premises is not on the premises at the time of the alarm event, the owner is not able to direct the central station monitoring facility whether to cancel or continue with authority dispatch.

The current call flow process from a security or premises monitoring system direct to a Central Monitoring Station, which calls the premises for verification and then notifies the authority for emergency dispatch, is an inefficient premises monitoring solution. This call flow configuration also has adverse cost and safety implications for the system owner, central station monitoring facilities, authorities, and cities alike.

It is therefore an object of the invention to provide an improved system for monitoring premises security and other conditions. It is a primary object of this invention to provide a system that transmits interactive notifications about premises event and alert information in the order and manner determined by the customer within the customer profile to any wired or wireless communication device. It is yet a further object of this invention to receive transmissions of alarm notifications regarding changes in the status of any one of a number of sensors or parameters in a security or premises monitoring system at a remote Information Management Network via the Public Switched Telephone Network, Wireless Commercial Network, cable network or other commercial network.

It is another object of the present invention that the customer be able to remotely and securely access the Information Management Network via the Internet or telephone to modify and review the information in his Customer Profile and Event Log within the Information Management Network, using a secure web or telephone interface, to easily and securely maintain and update contact lists and notification preference points, schedule times for certain information notifications, update call flow sequences, access personal account information, review detailed alarm history, review results of notifications made to each of the delineated devices, review billing information, schedule non-alarm event notifications and update and review other alarm signal and hardware related information. It is another object of the invention that the Information Management Network initiate

periodic interactive notifications to customers to encourage them to update their Customer Profile by entering the correct digital or voice recognized pass code.

It is yet a further object of the invention that the customer be able to determine the order in which contacts will receive the event transmission and have the opportunity to cancel said event transmission prior to said transmission being sent to the central station monitoring facility or private guard service for authority dispatch. It is another object of the present invention that an authorized recipient of an event notification can cancel the transmission of the notification to the subsequent contacts in the notification sequence or a central station by entering the correct digital or voice recognized pass code. It is yet another object of this invention that a central station monitoring facility use the Information Management Network to contact customer devices listed in the Customer Profile concurrently or following the dispatcher's verification call to the home, to allow an authorized individual, remote from the premises, to cancel the alarm notification prior to dispatch of the authorities. It is still another object of the invention that the recipient of a notification call be able to be transferred or conferenced with the emergency authority through a digital or voice request. It is another object of the invention that the receipt of information by the recipient can be confirmed and a record kept in the event log database of the Information Management Network for retrieval and review at a later date by an authorized individual. It is another object of the invention that the Information Management Network complement or replace the functions of a central station monitoring facility.

SUMMARY OF THE INVENTION

The system of the current invention provides to users and central station monitoring facilities an efficient and affordable event notification solution in which the call flow configuration of the invention is designed to enhance the safety and convenience of the customer and reduce the incidence of police, fire, or other emergency dispatches generated by false alarms. The invention comprises a secure interactive and remotely accessible Information Management Network (IMN) based routing system for alert, medical, and other emergency event information. The system delivers sequential interactive event notifications based on signals received from sensors at the monitored premises and sends them in text, voice, DTMF or digital, text messaging, or other formats to a plurality of remote wired and wireless devices, including cell phone, pager, email, SMS, landline phone, text messaging device, personal digital assistant, and fax as appropriate. The IMN further delivers such notifications to a pre-designated central station monitoring facility in security industry format.

The hardware of the IMN is a combination of a plurality of modems, an alarm monitoring engine, at least one server containing customer information databases, a unified messaging platform, event logs, web and telephony interfaces, an interactive messaging server, a Private Branch Exchange/Interactive Voice Response (PBX/IVR) interface, and a telephone conferencing switching mechanism. This configuration translates the data received from a premises hardware unit into a notification capable of being sent in voice or text format to any number of customer designated devices including telephone, fax, email addresses, pager, Personal Digital Assistant (PDA), or text messaging device. The systems are redundant.

The IMN routing system is domiciled at a secure independent hosting facility or at a secure central station monitoring facility. The system is able to receive event and alert information from any security or premises monitoring devices and sequentially transmit interactive notifications about the event and alert to wired and wireless communications devices specified in the Customer's Profile within the IMN. Transmissions can be made in voice, text, DTMF, digital, text messaging or other formats to such devices as cell phone, pager, email, fax, text message device and SMS, as well as in Contact ID, SIA, or other security industry formats to an independent central station monitoring facility for them in turn to dispatch the authorities.

The automated secure remote IMN has a novel interactive alarm notification call flow sequence that uses information stored in the Customer Profile within the database of the IMN to notify designated points of contact by making sequential interactive notifications to one or more persons or locations previously designated in the Customer Profile over one or more wired and wireless devices in text, voice, DTMS, text messaging or digital formats to notify them of an emergency event or a change in the status of any premises sensors. Delivery to any of the above destinations occurs in the order and manner specified in the authorized user's Customer Profile within the IMN.

For an alarm notification, the information conveyed can include the customer name, address, location of the security or premises hardware, phone number of the security or premises hardware, date, time, type and name of sensor, zone, local emergency authority phone number, and other relevant personal or premises-related information. The IMN also allows for a two-way communication interface with the security or premises hardware.

The IMN, having automatically received an alert notification from the premises where the monitoring devices are located, automatically accesses a data base, finds the particular owner's profile, and then also automatically sends interactive alert messages to phones, faxes, email devices, pagers, hand-held computers and/or a manned monitoring center as previously specified by the owner. The use of the alarm system is electronically logged in the IMN so that it can be reviewed later.

The system uses the information populated within the Customer Profile to instantly alert the customer and his contacts of the alarm event, for example, to warn them of an intruder on the premises or to alert them to another type of emergency event at the premises and enable them to make a decision as to whether the emergency authorities should be notified by the customer directly or through a central station monitoring facility or guard service, or the event notification should be cancelled.

The user can securely access the IMN via the Internet or telephone to program or re-program the user's customer profile, to include notification preference points, ordering of notifications, routing paths for different types of notifications, times for notification and other related information. This access is to a single universal access point. Receipt of information by the user can be confirmed and a record kept in the event log database of the IMN for retrieval at a later date by an authorized user.

The IMN also permits the user to modify the pre-existing premises alarm notification call flow sequence by allowing the user to direct and manage the alarm notification process. Event notifications from the IMN are interactive and made sequentially to the contacts designated in the Customer's Profile, allowing the recipient of the event notification to determine the next action to be taken by the IMN in the call flow sequence. Authorized recipients are able to terminate or

redirect subsequent event notifications by entering the correct pass codes digitally or through voice recognition technology.

Customers can select the number and ordering of contacts to be notified and queried prior to alarm event transmissions being sent to the central station monitoring facility for emergency authority dispatch. Customers can select to have a central station monitoring facility as part of the call flow sequence, or have notifications sent only to the contacts listed in their profile for those contacts to notify emergency authority for dispatch. Authorized users can access their Customer Profile via a pass code encrypted telephone or Internet interface, to change alarm system configuration, update their points of contact, establish the order in which contacts will be notified based on the type of alarm event and review emergency information any time they desired. Using the pass code accessible Internet and telephone interfaces, users can access information about their accounts, including billing information, contact points, pass code information and alarm history. The invention also provides for externally specified and changeable control of alarm system operation and home automation devices via the IMN or from a remote telephone. Externally directed control of alarm system operation and home automation devices takes place via the IMN.

The ability to securely and easily update contact information at anytime and from anywhere allows the customer to be part of and closely manage the security notification call flow process and enhance his safety by directing alarm event notifications to contact him on specified devices early on in the event notification process. This feature, coupled with the user's ability to cancel an alarm notification prior to its being sent to the central station monitoring facility, influences the call flow sequence of alarm event information and reduces the incidence of false alarm dispatches. Authorized contact recipients are identified with user-determined pass codes, verified by a digital pin number or Voice Recognition pin number, prior to that person instructing the IMN as to the next step or steps of action to be taken in the call sequence. Another important feature is the logging of event notification information into the database of the IMN so that the customer can review it at a later date.

In this system users have direct, secure access to the monitoring network database via phone or the global computer network in order to review and change alarm system configuration, points of contact and emergency information any time they desire. Customers have access to securely manipulate their personal information within their Customer Profile over the telephone or through a web interface, 24 hours a day.

Customers can elect to have central station monitoring facility back-up capability to be employed after one or more contacts listed in the Customer's Profile have been contacted and queried, and have failed to receive or respond correctly to the interrogation from the IMN. Customers can also elect not to have a central station monitoring facility as part of the call flow sequence and have the notifications sent only to the contacts listed in their Customer Profile. In all notification calls, customers are provided the opportunity to be transferred directly to the emergency authority for them to initiate a dispatch to the premises.

In certain instances, customers can select to have a central station monitoring facility or guard service notified for police or emergency dispatch, after one or more of the contacts listed in the Customer Profile have received the information and have either failed to properly cancel the event notification or have proactively instructed the IMN to contact the central station monitoring facility or guard service for dispatch. At the same time, recipients of alarm and event notifications are provided the local police number, as well as the ability to be transferred or conferenced with the local police or emergency authority.

Through the IMN, customers can also subscribe to receive notifications with content not related to the security or premises hardware. Such notifications include medication reminders, homeland security notifications and news events, transmitted at specific times, on specific dates, or under specific circumstances, and transmitted to a plurality of wired and wireless devices in text and voice formats as designated in the customer profile.

BRIEF DESCRIPTION OF THE DRAWINGS

1. FIG. **1** is a diagram of the communication flow established by the Information Management Network.

2. FIG. **2** is a diagram of the communication established by the Information Management Network including the central station monitoring facility or private guard service, the police, or other emergency authority.

3. FIG. **3** is a schematic diagram depicting the hardware components of the Information Management Network and the communications portals into and out of the Information Management Network.

4. FIG. **4** is a flow diagram illustrating the work flow process within the Information Management Network.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A Security or Premises Monitoring System has been previously described in the parent application, which has been incorporated by reference. The Security or Premises Monitoring System is connected by a communications circuit, which can be any of or a combination of elements selected from the public switched telephone network, a wireless network, digital subscriber line via modem, cable modem connected to a cable network, the internet, and any other communications network capable of transmitting dual tone multiple frequency tones or their equivalent. The Security or Premises Monitoring System connects on demand to the Information Monitoring Network (IMN) of this invention, described below.

With respect to hardware, the IMN comprises at least a DTMF modem, an application interface, at least one server containing customer information databases, a unified messaging platform, an event log, a web interface, and a telephony interchange, such as a Private Branch Exchange/Interactive Voice Response (PBX/IVR) interface. (See FIG. **3**). The at least one server comprises a server type computer the nature and configuration of which is well known to those skilled in the art. Those skilled in the art will also recognize that the network of this invention can be implemented with a variety of computing and communications hardware differing from those explicitly disclosed in this application but well known to those skilled in the art.

The hardware and software configuration translates the DTMF tones received from the Security or Premises Monitoring System into a message capable of being sent in voice or text format. As the following will describe, the IMN enables sending the message to any number of customer designated devices including telephone, fax, email addresses, pager, or Personal Digital Assistant (PDA) such as a PALM PILOT.

Referring to FIG. 1, alarm or event information is sent from the Security or Premises Monitoring System 1 to the remote Information Management Network 2 via any type of communication channel. The system retrieves user information and alert notification addresses (including but not limited to phone numbers, fax numbers email addresses, pager numbers, and Personal Digital Assistant device addresses) from the customer database and, as described in more detail below, forwards the alarm notification or medical information to the designated points of contact, simultaneously or sequentially. For an alarm notification, the information conveyed includes the customer name, location of the base unit, phone number of base unit, date, time, type of sensor and zone.

Interactive notifications are then sent from the Information Management Network to the contacts listed in the Customer Profile 17 (shown in FIG. 3) via at least one communication device, including cell phone, pager, email, SMS, landline phone, fax or text messaging device. Contact recipients of the interactive alert notifications are provided the option to cancel the event notification by providing a correct pass code using digital entry or voice recognition technology; send the alert notification to the next contact in the Customer Profile 17, or be transferred to or conferenced with the local emergency authority. There is no central station monitoring facility associated with the call flow sequence of FIG. 1.

Referring to FIG. 2, alarm or event information is sent from the Security or Premises Monitoring System 1 to the remote Information Management Network 2 via any communication channel including the Public Switched Telephone Network, the Internet, Cable or a Wireless Network. Interactive notifications are then sent to the contacts by the Information Management Network listed in the Customer Profile 17 (shown in FIG. 3) via any number of communication devices including cell phone, pager, email, SMS, landline phone, fax or text messaging device. Contact recipients of the interactive alert notification are provided the option to: cancel the event notification by providing the correct pass code using digital or voice recognition technology; send the alert notification to the next contact in the Customer Profile 17; send the alert notification to the central station monitoring facility. In this configuration, the central monitoring station is generally responsible for police and emergency authority notification for dispatch, but optionally the responder can be transferred to or conferenced with the local emergency authority.

Referring to FIG. 3, information sent from the Security or Premises Monitoring System 1 to the Information Management Network 2 enters the Information Management Network 2 through the Telephony Server 11, Cable Modem 12 or IP Server 14. Alarm information then flows through the Alarm Monitoring Engine 15 to the Database Server 16. Information regarding the specific account is stored in the Customer Profile 17 within the Database Server 16 that provides the work flow process for each alarm event. All alarm notification events are sent by the Interactive Messaging Server 18 to the customer contacts via landline phone, cell phone, text messaging device, pager, email, fax or SMS. The Interactive Messaging Server 18 can interrogate the contact recipient of the alarm notification for information and institute the appropriate work flow process based on the response of that contact. The results of all work flow processes are stored the Event Log 19 and can be reviewed by authorized individuals through the Telephony Interface into the Telephony Server 11 or the Web Interface through the Web Server 20. During a notification, customers are provided the option to be connected to the police phone number listed in their Customer Profile 17 within the Database Server 16. This connection is made through the Telephone Conference Switching Mechanism 21. Alarm notifications associated with central station monitored accounts are transmitted from the Database Server 16 to the central station monitoring facility via the Interactive Messaging Server 18 following the call flow sequence designated in the Customer Profile 17. Access to the Customer Profile 17 and changes to said Customer Profile 17 are made through the Telephony Server 11, Customer Service Receiver 22 and Web Server 20 into the Information Management Network 2.

Referring to FIG. 4, the call flow processes are detailed for an alarm event. When the incoming signal is received by the Information Management Network 2, the signal enters the Alarm Monitoring Engine 15 and is immediately logged into the Event Log 19 within the Database Server 16. The alarm notification string is parsed to determine information about the account. Using the customer identification number, the Customer Profile 17 within the Database Server 16 is queried for the alarm type and customer account information for the work flow processes.

For a central station monitored account, there are different workflows associated with non-critical, critical, panic, and fire events. In the event of a non-critical alarm, which represents a low battery event, AC Power loss or other non-critical event, the alarm event information is sent by the Notification Engine 23 within the Interactive Messaging Server 18 to the customer's non-critical contact on the device specified in the Customer's Profile 17. The results of this notification are stored in the Event Log 19 within the Database Server 16. In the event of a critical alarm, the information is sent to the customer's first contact using the Notification Engine 23 within the Interactive Messaging Server 18. The contact is given the option to cancel the alarm or send the signal to the central station monitoring facility 8 for dispatch.

If the contact request's that the central station monitoring facility 8 be notified for the dispatch of the authorities, the Notification Engine within the Interactive Messaging Server 18 sends the alarm transmission to the central monitoring station 8 for authority dispatch and the results of the work flow process are stored in the Event Log 19. All other contacts listed in the Customer's Profile 17 are then notified that alarm event notification was sent to the central station monitoring facility 8.

If the alarm notification information is sent to a device where the contact chooses to cancel the alarm event, the customer's notification cancel code is requested. If the correct alarm notification cancel code is entered, the alarm notification event and work flow process are cancelled and the information of the work flow process is stored in the Event Log 19.

If the incorrect alarm notification cancel code is entered, the customer is requested to re-enter the code. If an invalid alarm notification cancel code is entered second time, or no code is entered, the work flow process moves to the next contact listed in the Customer's Profile 17 and the notification process is repeated. When the second contact is notified, if there is no answer, an invalid cancellation code is entered or the contact selects to have the central station monitoring facility 8 notified, the alarm event is sent to the central station monitoring facility 8 for authority dispatch and the information is stored in the Event Log 19. In any case where a valid alarm notification cancel code is entered, the noti-

fication event and the workflow process are cancelled, and the information regarding the cancellation of the alarm event notification is stored in the Event Log **19**. In any case where the central station monitoring facility **8** is notified for dispatch, all remaining contacts are notified that the alarm event was sent to the central station monitoring facility **8** and the information is then stored in the Event Log **19**. When an alarm notification is sent, if the notification is unable to be delivered by the Information Management Network **2**, if the line is busy or there is no answer by the first contact listed in the Customer Profile **17**, the workflow process moves to the next contact listed in the Customer Profile **17**.

If the first contact is answered by a voice mail or answering machine, the Notification Engine **23** within the Interactive Messaging Server **18** recognizes that it is not a live person, leaves a message and the work flow process moves to the next contact listed in the Customer's Profile **17**. If the next contact is not answered, is answered by a voice mail or answering machine, or is answered and the correct alarm notification cancel code is not entered, the Notification Engine **23** within the Interactive Messaging Server **18** leaves a message where applicable and the alarm event notification is sent to the central station monitoring facility **8** and the remaining contacts listed in the Customer Profile **17** are notified that alarm event was sent to the central station monitoring facility **8**. This information is then stored in the Event Log **19** within the Database Server **16**.

In the event of a fire or panic alarm event, the information is sent directly to the central station monitoring facility **8** and all of the customer contacts listed in the Customer Profile **17** are notified of the alarm event. The information is stored in the Event Log **19**. There are no cancellation privileges associated with these events.

For an account that does not have central station monitoring, there are different workflows associated with non-critical, critical, panic, and fire events. In the event of a noncritical alarm, which represents a low battery event, AC Power loss, or other non-critical event, the information is sent to the customer's non-critical contact on the specified device, using the Notification Engine **23** within the Interactive Messaging Server **18**. The results of this notification are stored in the Event Log **19** within the Database **16**.

In the event of a critical alarm, the information is sent to the customer's first contact using the Notification Engine within the Interactive Messaging Server **18**. The contact is given the option to cancel the alarm event or send the signal to the next contact listed in the Customer's Profile **17**.

If the contact chooses to cancel the alarm event, the customer's notification cancel code is requested. If the correct alarm notification cancel code is entered, the alarm notification event and work flow process are cancelled and the results of the work flow process are stored in the Event Log **19**. If the incorrect alarm notification cancel code is entered, the customer is requested to re-enter the alarm notification cancel code. If an invalid alarm notification cancel code is entered a second time, or no alarm cancellation code is entered, the work flow process moves to the next contact listed in the Customer's Profile **17** and the process is repeated. This work flow process will continue through all of the customer contacts until the alarm event is cancelled using the correct alarm notification cancel code. With each notification, the contact is given the information about the alarm event, including the name, address and system zone activated, as well as the police phone number to contact in the event of an emergency. During the process, the contact is given the option to have the notification sent to the next contact listed in the Customer Profile **17**; given the option to cancel the notification; or be connected directly to the police phone number listed in his Customer Profile **17**. In any case when a valid alarm notification cancel code is entered, the notification event and the workflow process are cancelled and the information is stored in the Event Log **19** within the Database Server **16**. When an alarm notification is sent, if the line is busy or there is no answer by the first contact listed in the Customer Profile **17**, the workflow process moves to the next contact listed in the Customer's Profile **17** to continue the work flow process.

In the same event, if the notification is answered by a voice mail or answering machine, the Notification Engine **18** recognizes that it is not a live person, leaves a message and the work flow process moves to the next contact listed in the Customer's Profile **17**. If the next contact is busy, not answered, answered by a voice mail or answering machine, or answered and the correct alarm notification cancel code is not entered, the Notification Engine **18**, leaves a message where applicable and moves to the next contact listed in the Customer's Profile **17**. This process continues through all of the contacts listed in the Customer's Profile **17** until the correct alarm notification cancel code is entered to cancel the work flow process.

After the work flow process has attempted contact with all devices listed in the Customer's Profile **17**, the Notification Engine **23** within the Interactive Messaging server **18** will try to send the alarm notification to those devices that were busy or where there was no answer to attempt to deliver the alarm event notification information.

In the event of a fire or panic alarm event, all of the customer contacts listed in the Customer Profile **17** are notified of the event and the results of the notification are stored in the Event Log **19** within the Database Server **16**. There are no cancellation privileges associated with these events.

Confirmation that the alarm notification has been successfully transmitted to the customer's designated device(s) is housed in the event log and also in the Security or Premises Monitoring System. In a preferred embodiment, the IMN allows for a two-way communication interface with the base unit. In this way, the present invention allows for remote activation or resetting of the alarm and other devices in the home for security and home automation purposes, through the initiation of a phone call or global computer network transmission to the IMN. The IMN also allows the customer to preprogram alarm and home automation functions to initiate specific processes at specified times of the day.

The Information Management Network **2** can be programmed to forward certain alarm event transmissions directly to the central station monitoring facility **8** while other event transmissions are sent to the central station monitoring facility **8** only after the first, second, third or fourth transmission to the contacts listed in the Customer Profile **17**.

Referring to FIG. **3** again, the account information in the Customer Profile **17** within the Information Management Network **2** can be populated by the customer or other authorized individual via a secure web interface on the Web Server **20** or via a secure telephone interface using the Telephony Server **11**. To access their Customer Profile **17**, customers are required to provide their personal user name and a unique personal pass code. Through these interfaces, authorized individuals can customize their personal account information to add, delete or modify their pre-designated contacts and designate the order of alarm event information

transmissions to their contacts, modify their home address, phone number, police contact number, and billing information. Any change made to data within the Customer Profile **17** is automatically sent via PSTN or Internet interface to the central station monitoring facility **8** to update the customer's account information on a real time basis. This transfer of information applies only to those customers subscribing to central station monitoring services, which services serve as a complement to the alarm notification call flow process made by the Information Management Network **2**.

What is claimed is:

1. An information management network system for routing information to one or more recipients, said network system comprising:

a) means for receiving information from a monitoring system;

b) one or more user profiles, each of the one or more user profiles comprising one or more specified notification contact data entries and a specified notification contact flow sequence;

c) means for selecting a single user profile corresponding to the monitoring system and for retrieving the selected single user profile;

d) means for extracting from the selected single user profile the one or more specified notification contact data entries and the specified notification contact flow sequence;

e) means for identifying from each of the one or more notification contact data entries one or more communication receiving devices and for each such device a device-specific format, each of said communication receiving devices being configured both to receive messages in device-specific formats and to transmit a response message back to the information monitoring network;

f) means for generating from the information received from the monitoring system and from each of the one or more notification contact data entries one or more interactive event notifications, each in a device-specific format corresponding to each of the one or more configured communication receiving devices;

g) means for transmitting said one or more interactive event notifications in device-specific formats to each of the one or more configured communication receiving devices either sequentially or simultaneously according to the specified notification contact flow sequence;

h) means for receiving from each of the one or more communication receiving devices, either sequentially or simultaneously according to the specified notification contact flow sequence, additional information or instructions containing specified subsequent actions to be taken by the network;

i) means for altering the specified notification contact flow sequence according to the specified subsequent actions contained in the additional information or instructions received from each of the one or more configured communication receiving devices; and

j) means for carrying out subsequent actions to be taken by the network according to the altered specified notification contact flow sequence.

2. The information management network system of claim **1** wherein the monitoring system is a premises monitoring system.

3. The information management network system of claim **1** wherein the information received from a monitoring system comprises an alarm or event notification.

4. The information management network system of claim **2** wherein the premises monitoring system is located remotely from the network system at a remote premises.

5. The information management network system of claim **1** wherein the user is a customer of an entity maintaining the information management network system.

6. The information management network system of claim **1** additionally comprising a premises monitoring system.

7. The information management network system of claim **1** additionally comprising

a) one or more event logs corresponding to the one or more user profiles; and

b) means for storing in the event log information comprising the information received from the monitoring system and information regarding the one or more interactive event notifications sent by the network.

8. The information management network system of claim **7** additionally comprising means for the user to access and retrieve information stored in the event log.

9. The information management network system of claim **1** additionally comprising:

a) means for enabling a user to remotely access the user's user profile and the corresponding event log; and

b) means for enabling the user, after having accessed the user's profile, to change the specified notification contact data entries and the specified notification contact flow sequence, thereby changing the order and manner in which event notifications are transmitted to the one or more configured communication receiving devices.

10. The information management network system of claim **9** wherein the means for enabling a user to remotely access the user's user profile and the corresponding event log is either a telephone interface or an internet interface.

11. The information management network system of claim **1** in which the one or more configured communication receiving devices to which interactive event notifications are directed are selected from the group: cell phone, e-mail, pager, land line phone, text messaging device, short messaging system, facsimile machine, and all combinations thereof.

12. The information management network system of claim **1** in which at least one of the one or more configured communication receiving devices is located at a staffed central station, and in which the device-specific format is a security industry data format, whereby the staffed central station is enabled to notify emergency authorities of the information received from the monitoring system.

13. The information management network system of claim **12** in which the staffed central station is enabled to send notification of an event to the user's home and to route a notification to the user at another location either concurrently with the notification to the home or sequentially.

14. The information management network system of claim **1** additionally comprising a means for voice telephone conferencing.

15. The information management network system of claim **1** additionally comprising means for sending out messages to users reminding them to update their user profiles.

16. The information management network system of claim **15** wherein the means for sending out messages to users comprises via email providing a link whereby to the web site for users can update their user profiles.

17. The information management network system of claim **15** wherein the means for sending out messages to users comprises a telephone interface, whereby the user is enabled to use the telephone key pad to update the user's user profile.

18. A method of routing information to one or more recipients comprising the steps of:

a) receiving information from a monitoring system;

b) storing one or more user profiles, each of the one or more user profiles comprising one or more specified notification contact data entries and a specified notification contact flow sequence;

c) selecting a single user profile corresponding to the monitoring system

d) retrieving the selected single user profile;

e) extracting from the selected single user profile the one or more specified notification contact data entries and the specified notification contact flow sequence;

f) identifying from each of the one or more notification contact data entries one or more communication receiving devices and for each such device a device-specific format, each of said communication receiving devices being configured both to receive messages in device-specific formats and to transmit a response message back to the information monitoring network;

g) generating from the information received from the monitoring system and from each of the one or more notification contact data entries one or more interactive event notifications, each in a device-specific format corresponding to each of the one or more configured communication receiving devices;

h) transmitting said one or more interactive event notifications in device-specific formats to each of the one or more configured communication receiving devices either sequentially or simultaneously according to the specified notification contact flow sequence;

i) receiving from each of the one or more communication receiving devices, either sequentially or simultaneously according to the specified notification contact flow sequence, additional information or instructions containing specified subsequent actions to be taken by the network;

j) altering the specified notification contact flow sequence according to the specified subsequent actions contained in the additional information or instructions received from each of the one or more configured communication receiving devices; and

carrying out subsequent actions to be taken by the network according to the altered specified notification contact flow sequence.

* * * * *